GLAST Large Area Telescope:

Environmental Test Operations Planning TIM

Mechanical Operations

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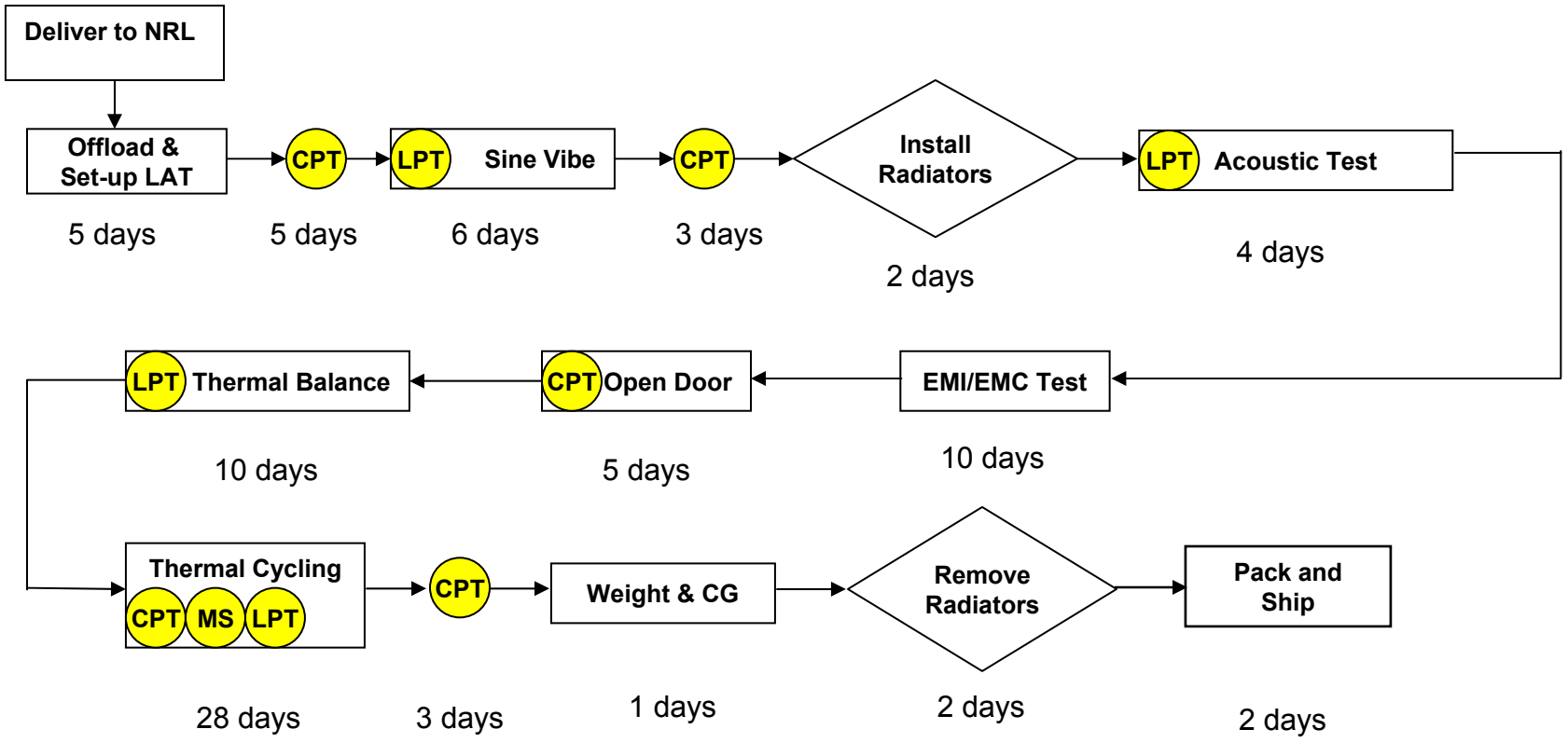
Agenda – NRL Mechanical Ops

- **Test Flow Summary**
- **Detailed Operations**
- **Issues – Forward work**
- **All LAT MGSE, Go To:**

  http://www-glast.slac.stanford.edu/IntegrationTest/MGSE/default_MGSE.htm

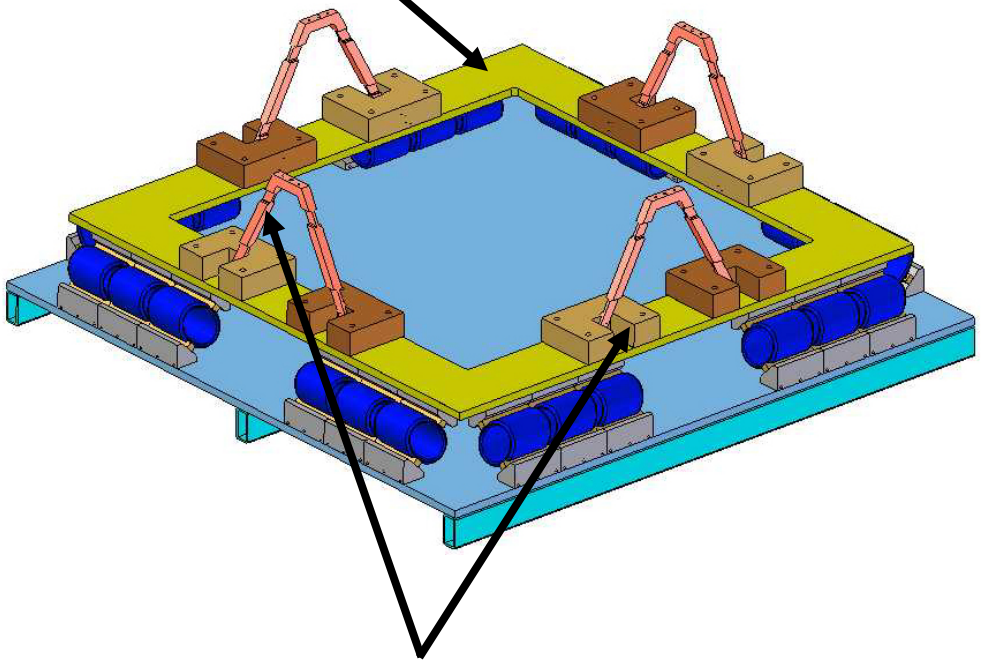
Proposed LAT Environmental Test Flow



Total Duration 86 Days

Ship Preparation at SLAC

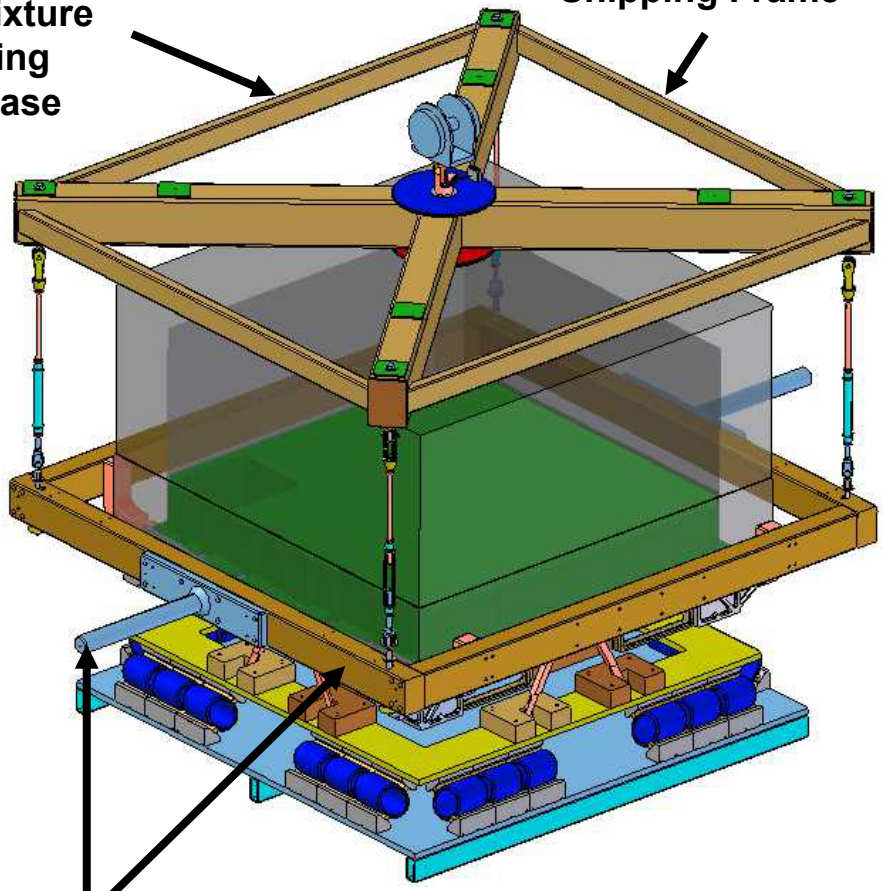
Base of LAT Shipping Container



Attach SC Flexures and Sine-Vibe Test Interface Plates

LAT wit Z Axis Vertical Lift Fixture onto Shipping Container Base

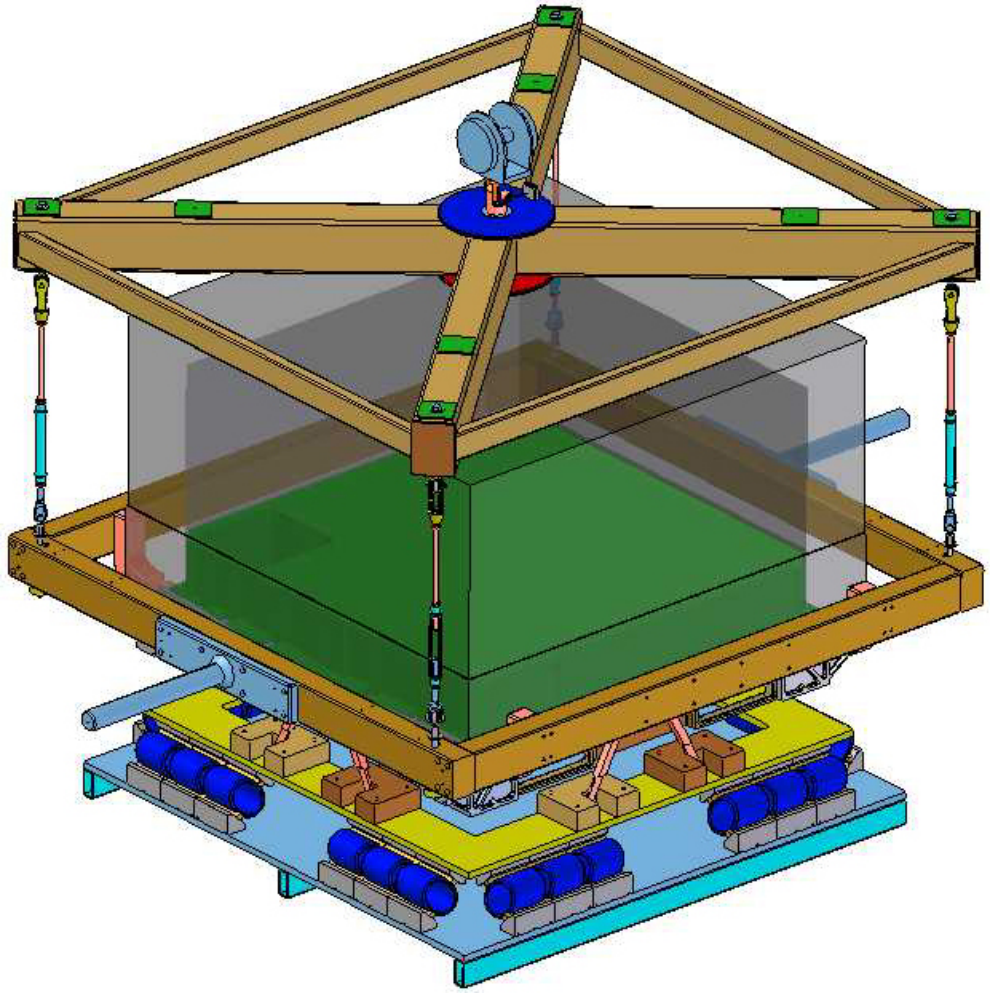
Lift Fixture Requires Shipping Frame



After LAT Attach to Base, GPR & Shaft-Flange Assy go back to Integration Stand, or its own shipping container, for shipment

Photo of LAT Lift Fixture

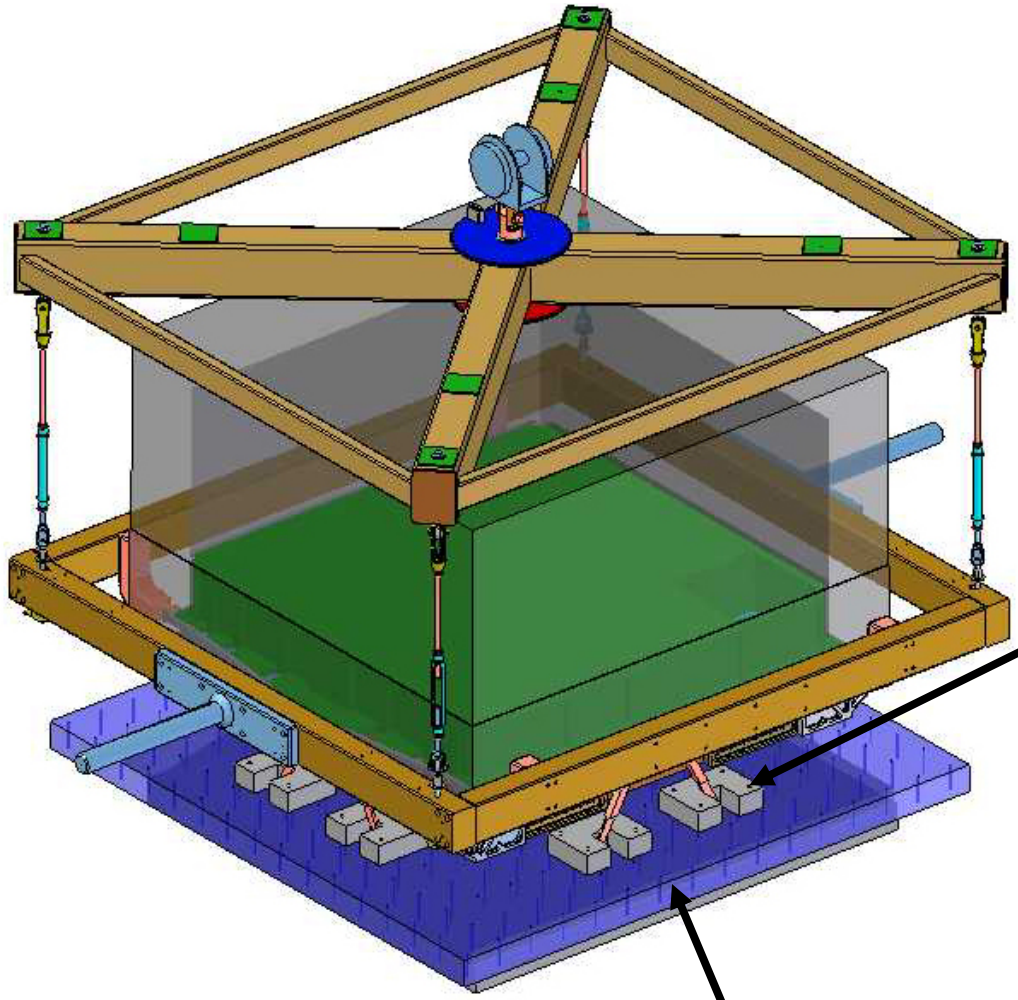
LAT Arrival at NRL



Post Ship CPT

- After LAT Arrival at NRL :
- Unpack and Prep LAT Z Axis Vertical Lift Fixture
- Move LAT in Shipping Container Close to Sine-Vibe Test Area
- Use Z Axis Vertical Lift Fixture to Remove LAT Shipping Container Cover
- Attach Z Axis Vertical Lift Fixture to LAT (With ~ 500 lbs Tension in Crane's Lift Cable)
- Remove Fasteners at Sine-Vibe Test Interface (from Shipping Container Base)
- Lift LAT Away and move to Vibe Test Interface

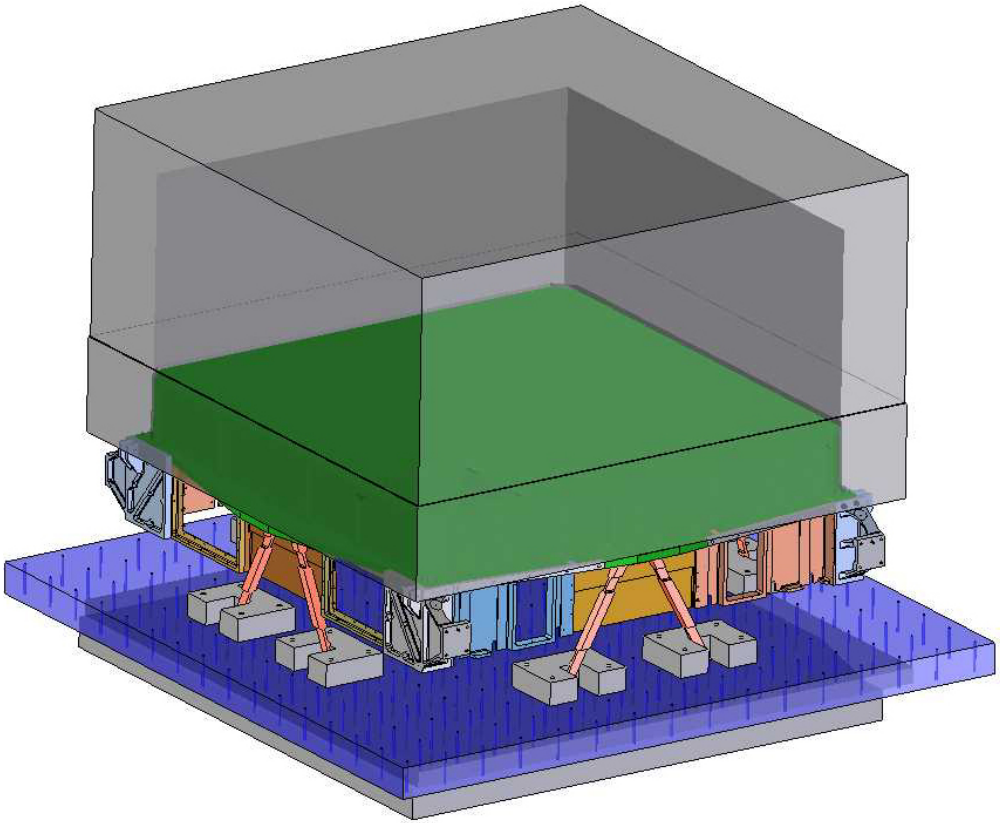
Prepare For X Axis Shake



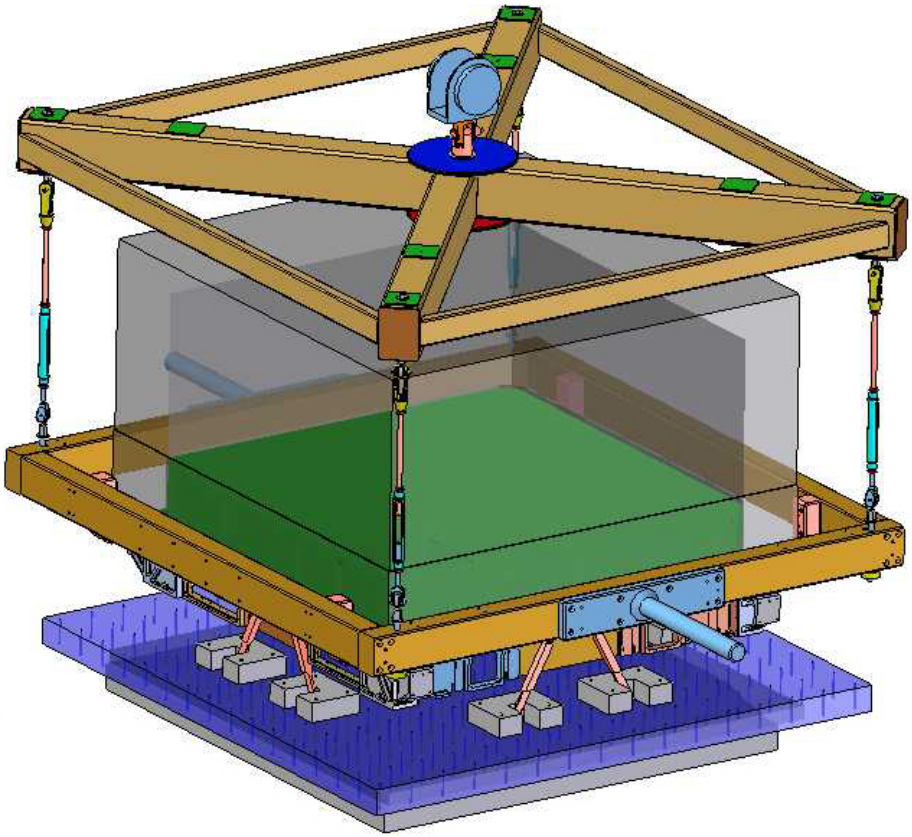
NRL Provided Vibe Test Interface

- Lower LAT to within ~ 10 mm of Vibe Test Interface Plate and Start Fasteners
- SLAC Provided "Horse Shoe Brackets
  - Fit Between SC and NRL Vibe Test Interface Plate
  - Passed Structural Analysis
  - Forward Work : Build and Fit "Horse Shoe" Brackets
- Lower LAT to Plate and Torque Fasteners
- Remove Lift Fixture at LAT's Four Clevice Pin Attach Points
  - GPR is Part of Lift Fixture
- Verify Data Management System is Receiving and Recording Data

X Axis Shake & Prep For Y Axis

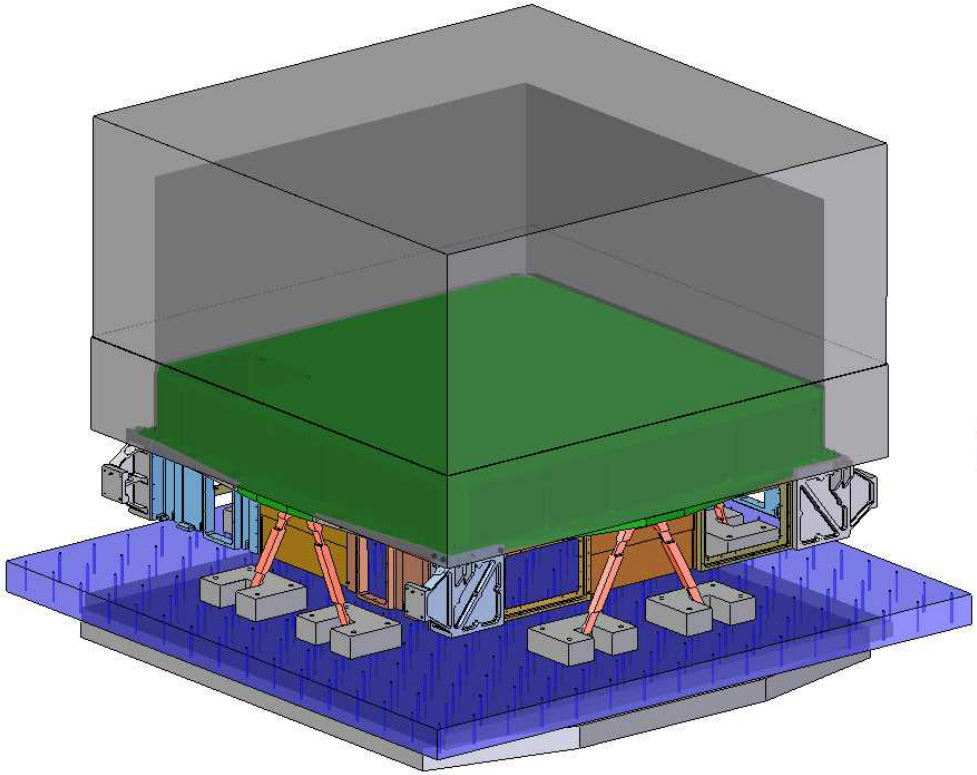


Perform X Axis Shake



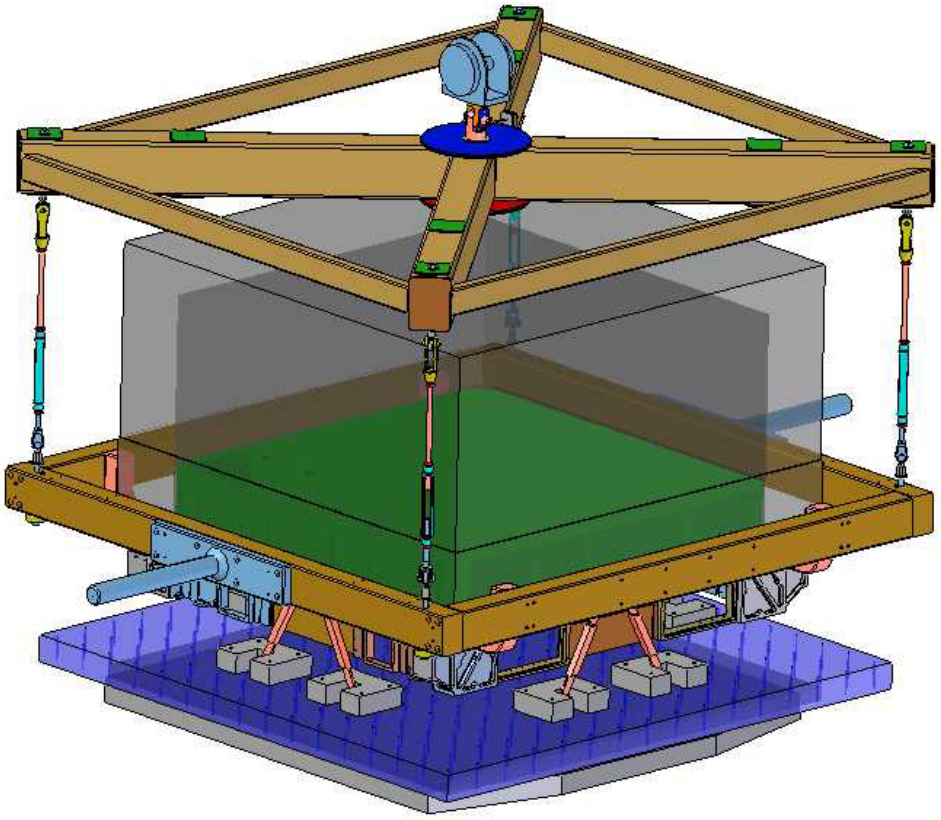
After X Axis Shake is Complete, Re-Attach Lift Fixture, Remove Fasteners, Lift & Rotate LAT 90° then Lower & Re-Attach Fasteners For Y Axis Shake

Y Axis Shake & Prep For Z Axis



Verify DMS is Functional, Then
Perform Y Axis Shake

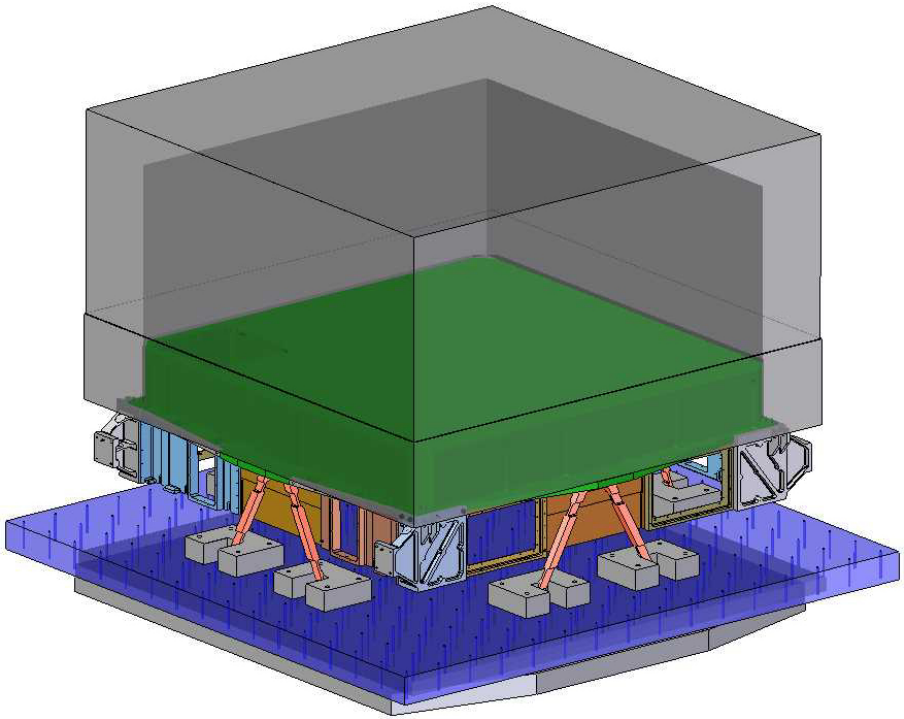
During NRL Z Axis Vibe Prep, LAT
Can Rest on Ship Container Base



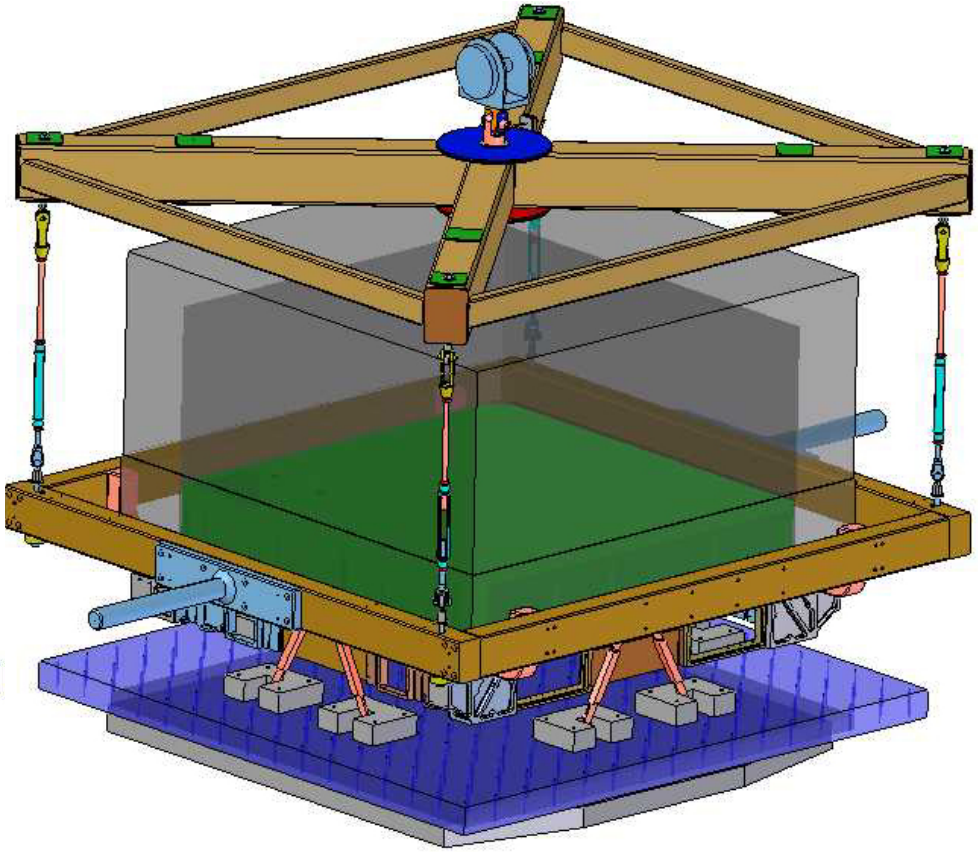
After Completion of Y Axis Shake, Re-Attach
Lift Fixture to Allow Z Axis Shaker Preps

Note: May Have to Remove LAT From
Interface Plate So That NRL Can Move Plate
to Z Axis Shaker Head Position

Z Axis Shake & Preps To Integration Stand



Verify DMS is Functional, Then Perform Z Axis Shake

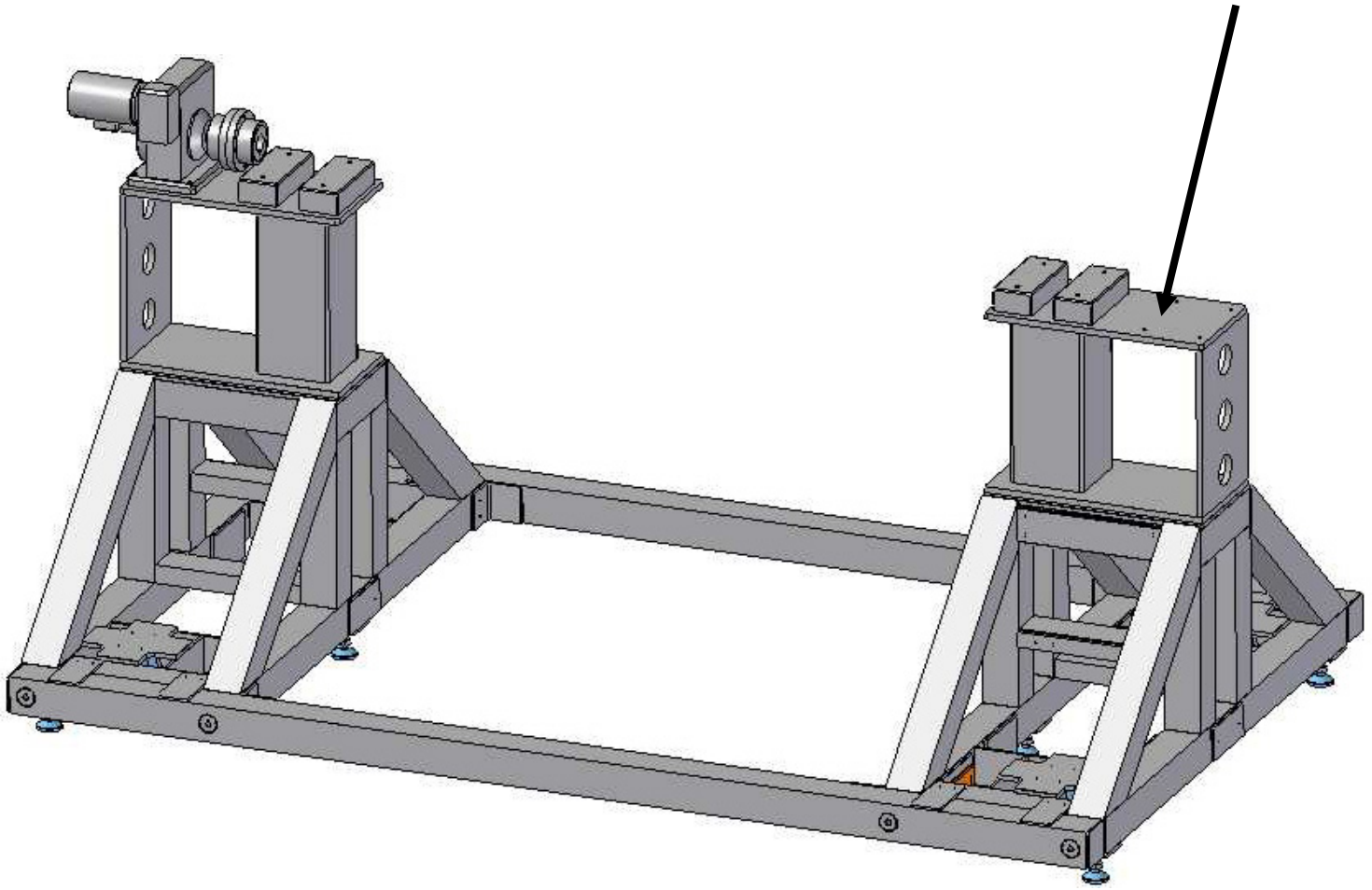


After Completion of Z Axis Shake, Re-Attach Lift Fixture to Prepare for Installation onto Integration Stand

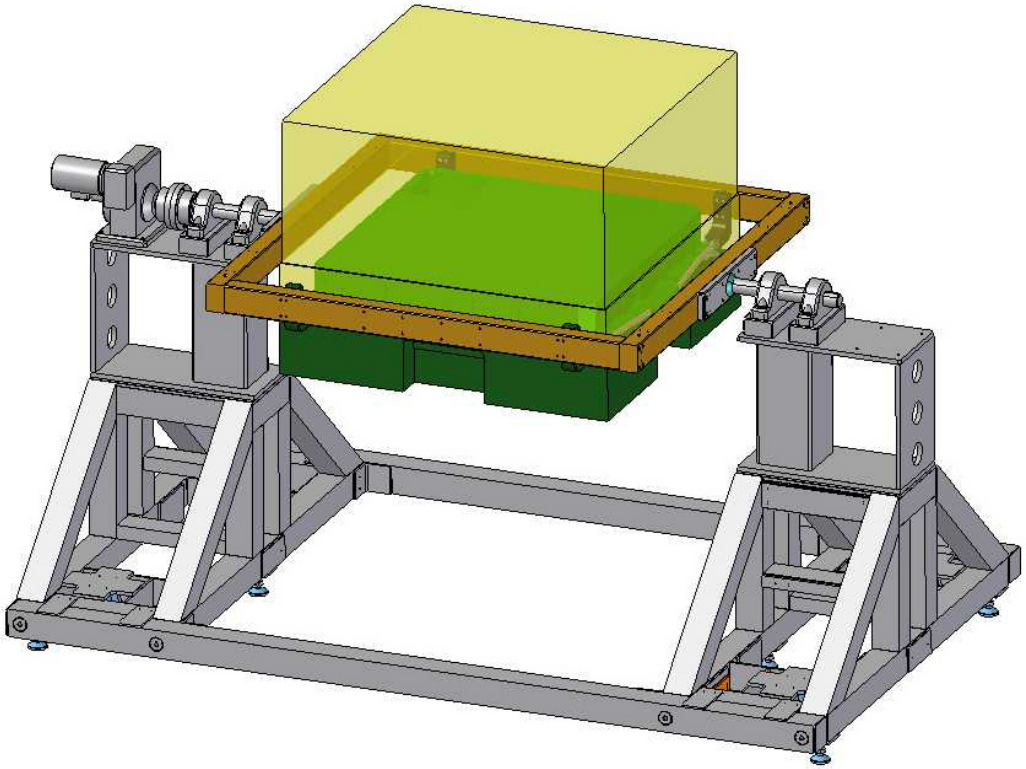
Integration Stand with Rotation Axis Risers

Rotation Axis Riser Blocks Installed During Sine-Vibe Test

Riser Blocks Raise Rotation Axis from 53” to 82-1/4” Relative to Floor



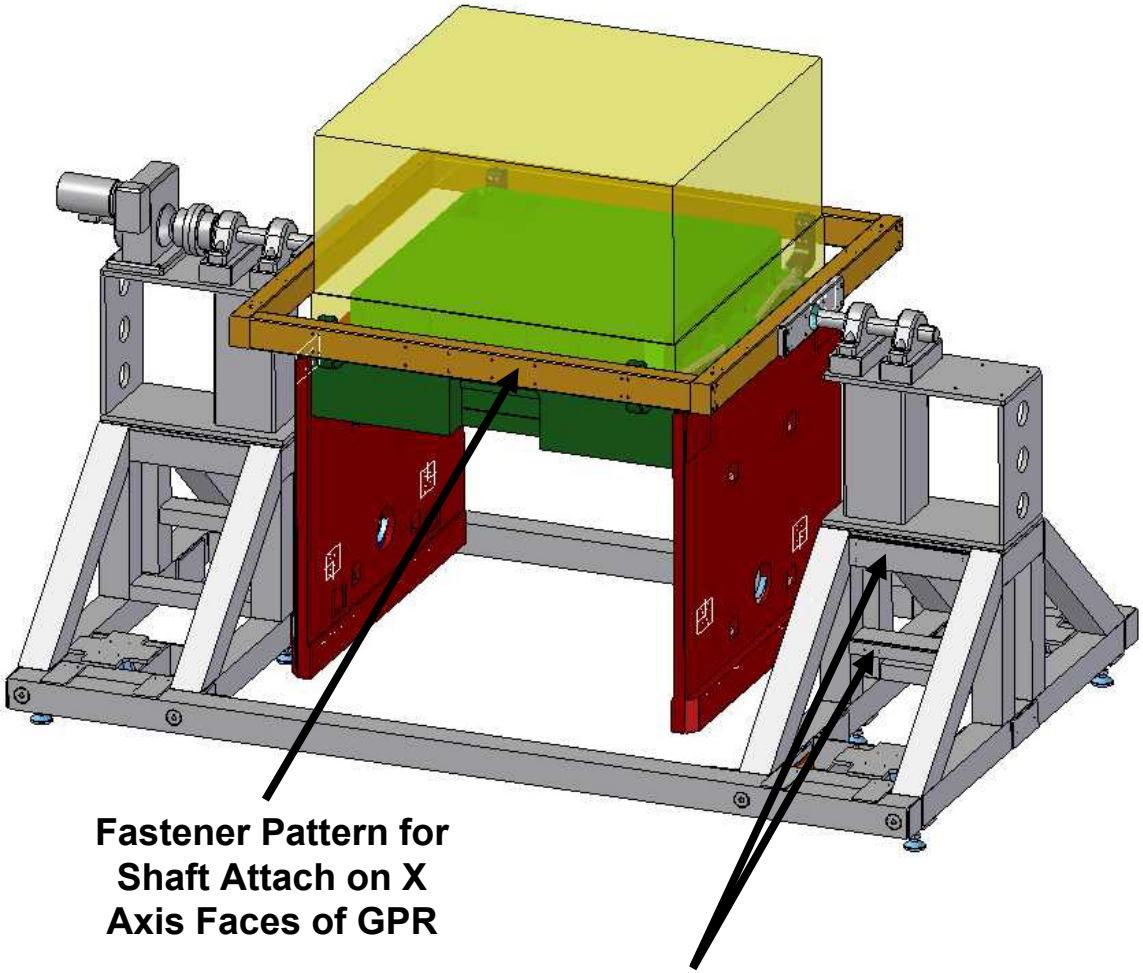
LAT Onto Integration Stand, Remove Lift Fixture



LAT with Lift Fixture Onto Stand

Remove Lift Fixture and Prepare LAT for Radiator Installation

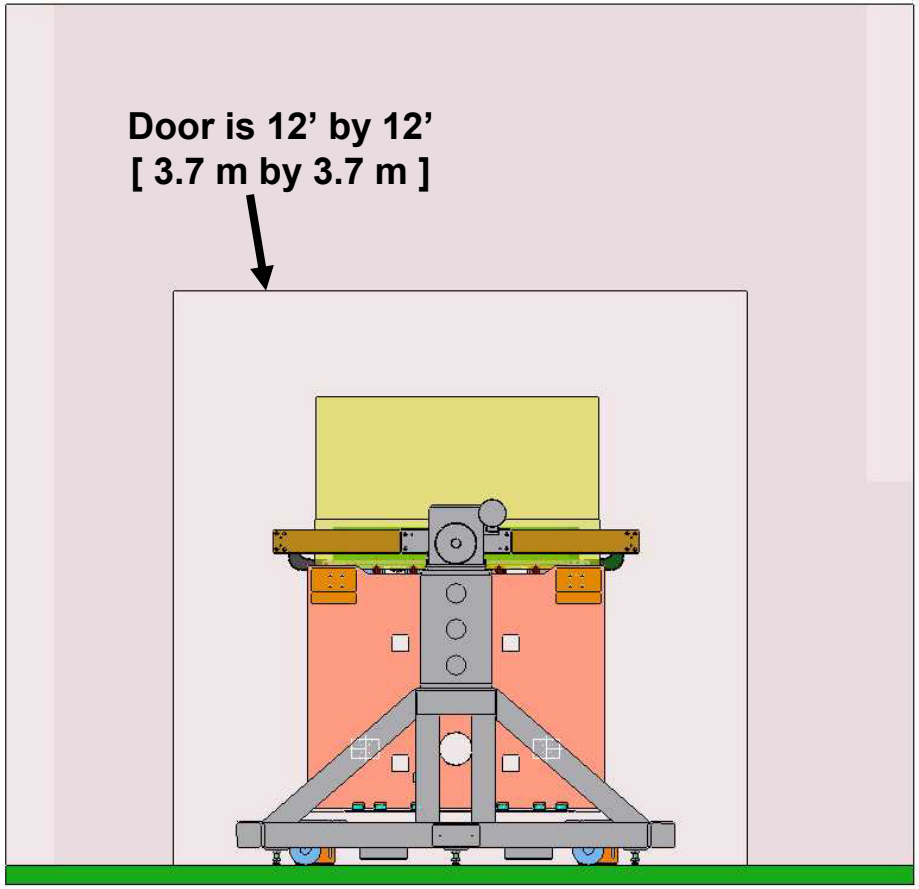
Install LAT Radiators



- PAPs Not Shown for Clarity
- May Have to Attach Support Shaft-Flange Assemblies on LAT X-Axis Faces of GPR to Provide Radiator Installation Access
  - GPR Has X Axis Fastener Interface
  - If This Is Required, Additional Crane Op Needed After Radiator Installation to Position Shafts Back Onto Y Axis Face
- Install TBD Radiator Supports and SC Simulator Plates
- Remove PAPs From Stand
- Affix Air Bearings to Bottom of Integration Stand
- Prepare for Move Into Acoustic Test Cell

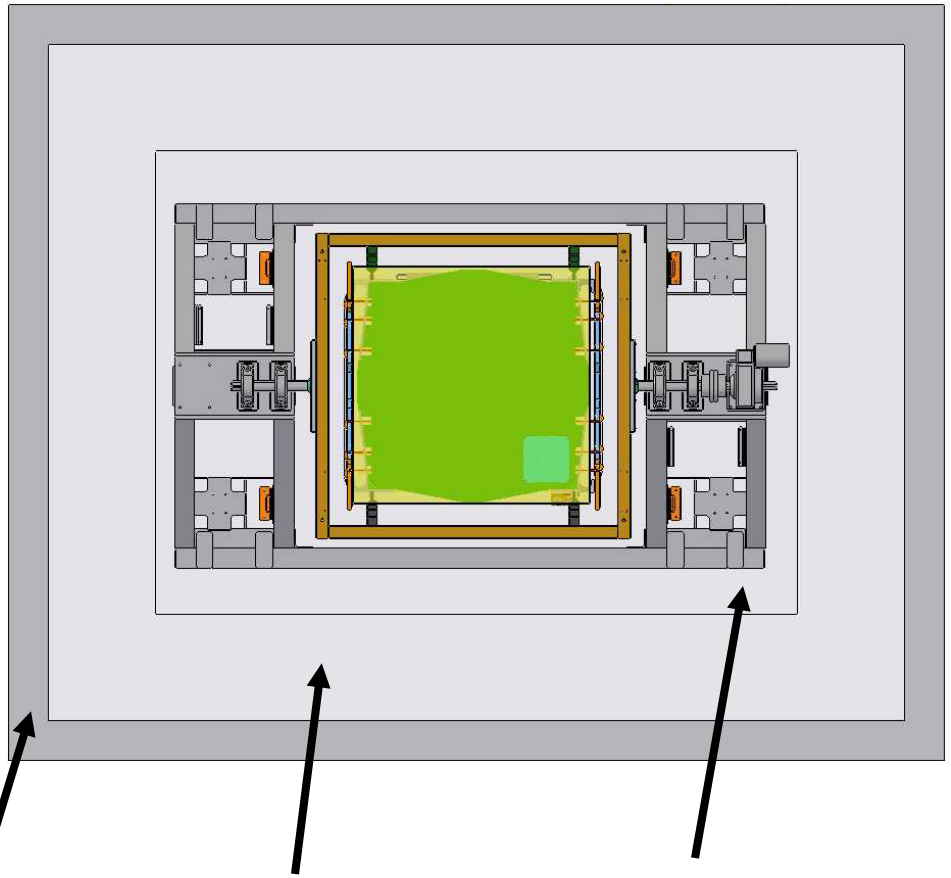
Move Into Acoustic Test Chamber

Scaled End View LAT with Respect to Acoustic Test Cell Door



Scaled Top View LAT with Respect to Acoustic Test Cell Foot Print,

21-1/2’ by 17’ [6.5 m by 5.2 m]

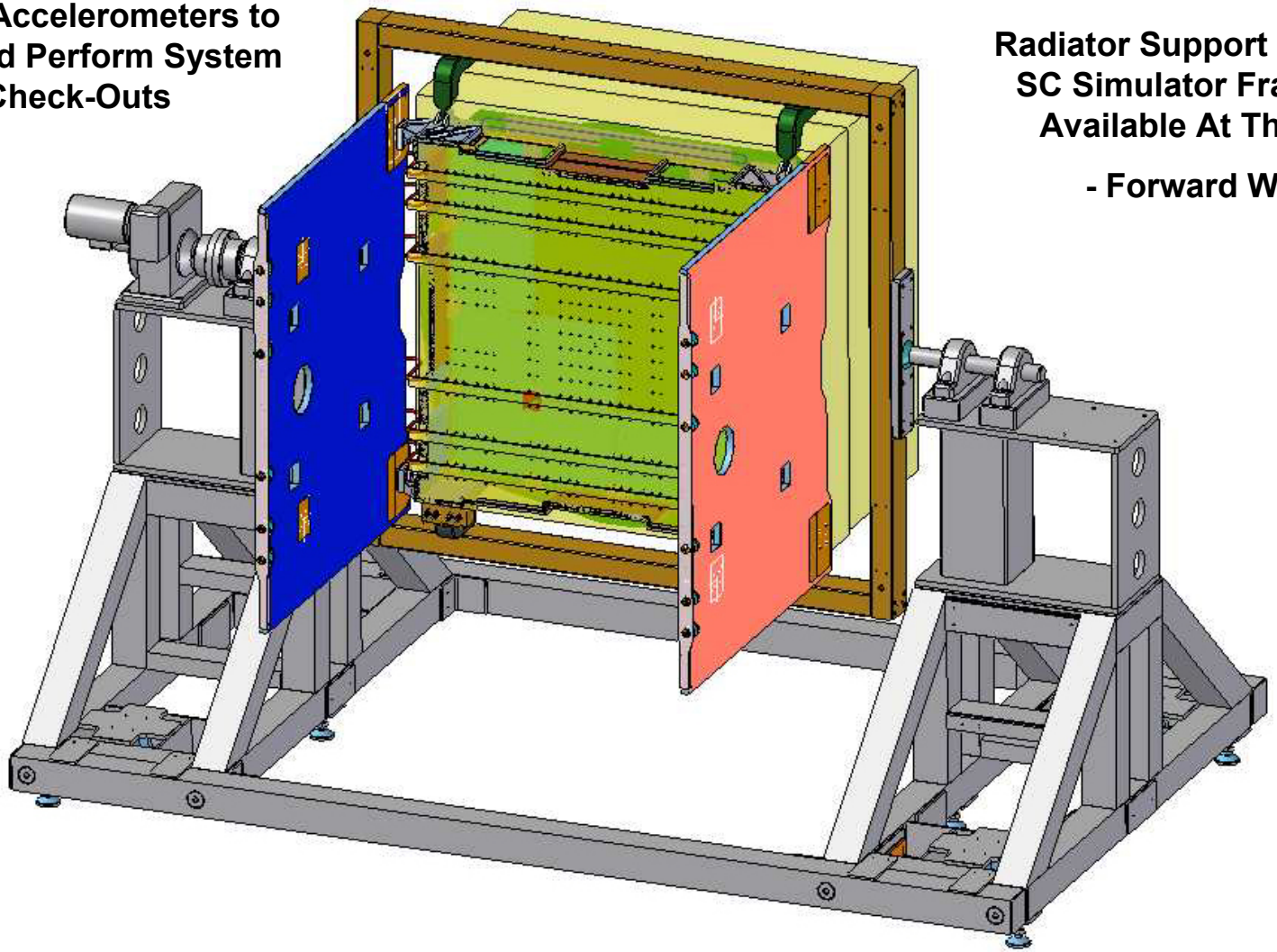


Prepare For Acoustic Test

Attach Accelerometers to DMS and Perform System Check-Outs

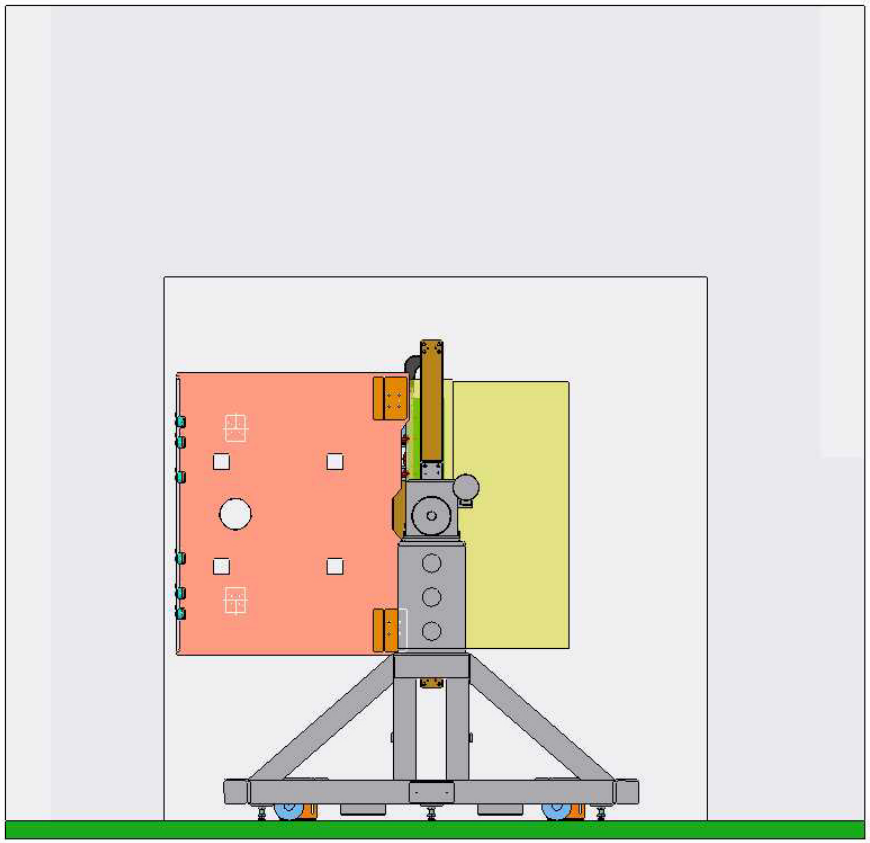
Radiator Support Struts and SC Simulator Frames Not Available At This Time

- Forward Work -

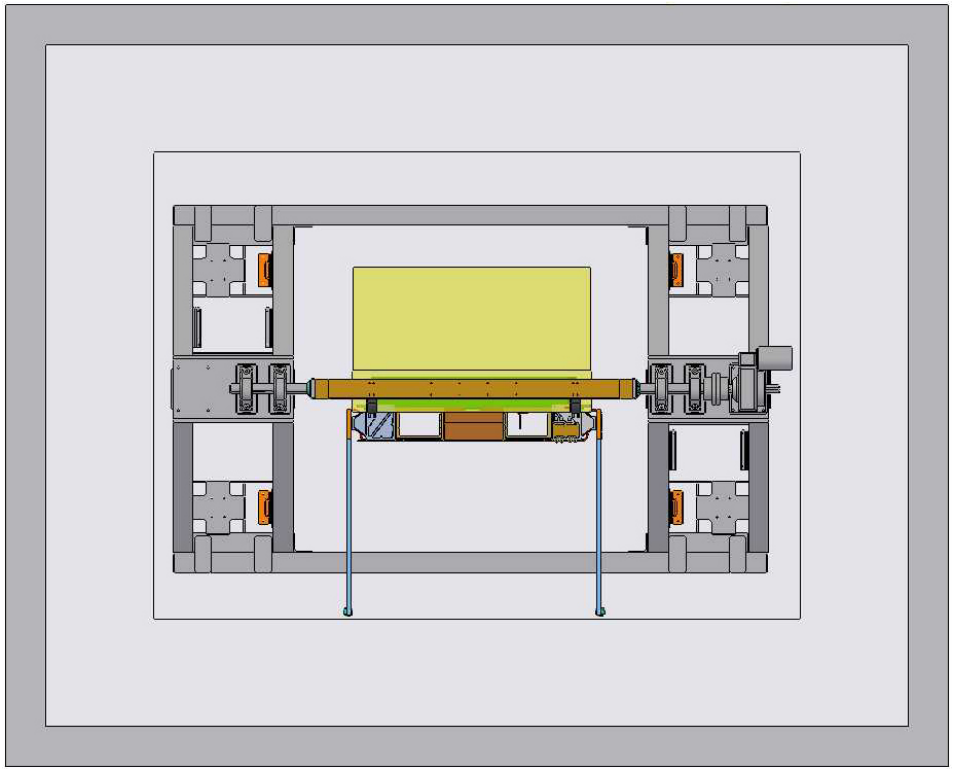


Perform Acoustic Test

After Z Vertical Move Into Chamber, Rotate LAT to Z Axis Horizontal



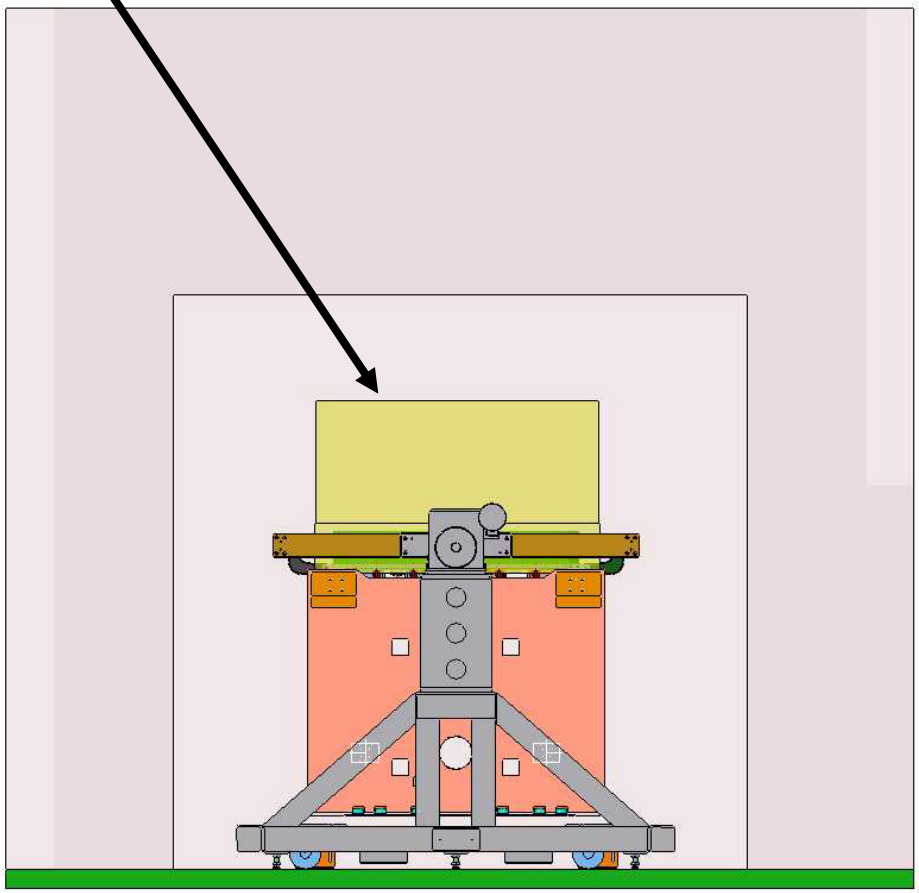
Scaled End View LAT with Respect to Acoustic Test Cell Door



LAT Centered in Chamber

Move Out of Acoustic Test Chamber

Rotate to Z Vertical for Move Out Of Acoustic Cell



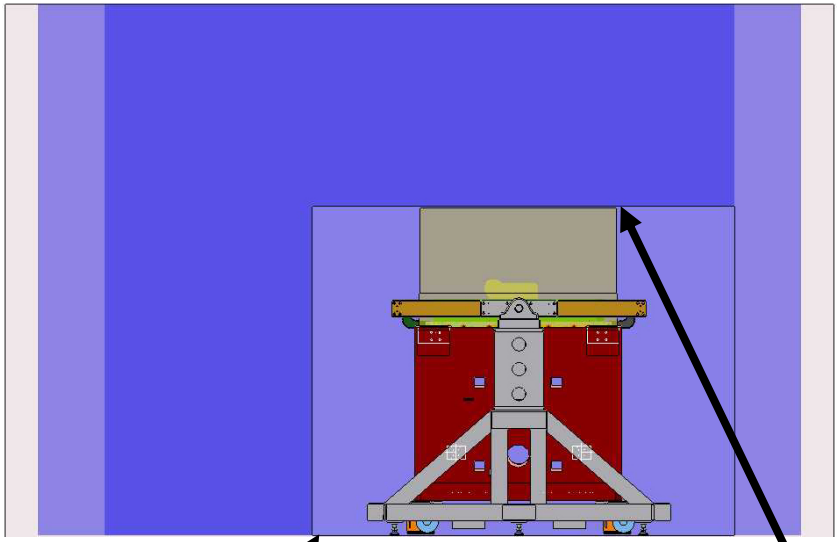
Move Out of Cell to Crane Area

Scaled End View LAT with Respect to Acoustic Test Cell Door

EMI Test Option 1

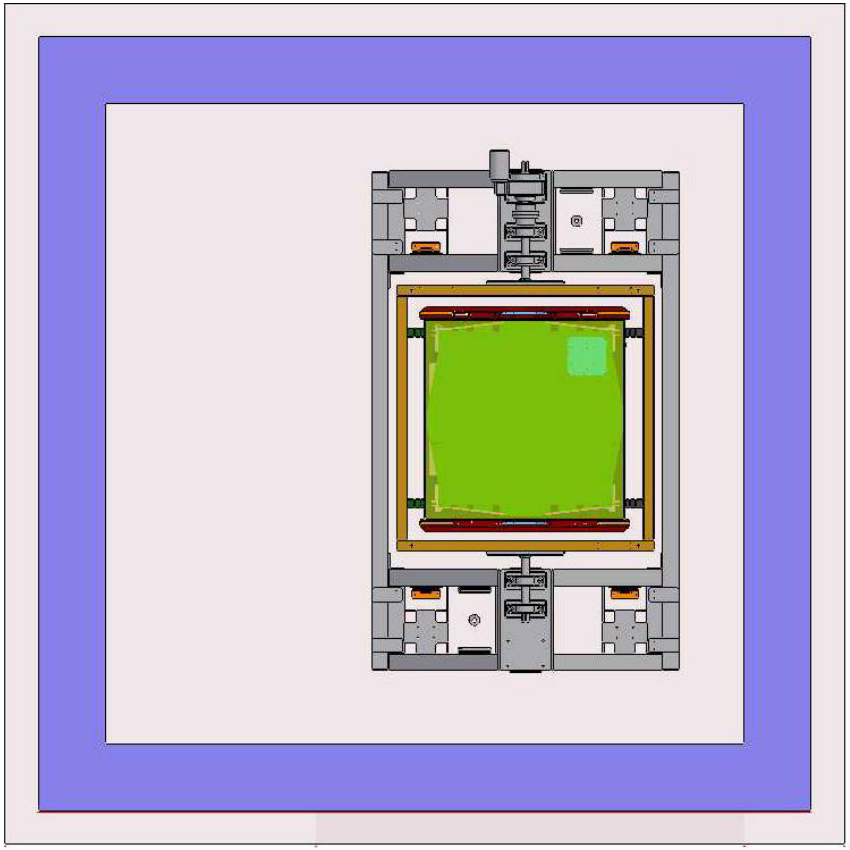
Option 1,

LAT on Integration Stand, Z Axis Vertical for Move



EMI Chamber Door Opening Is 12' 9" [3.88 m] Wide by 9' 11" [2.9 m] High

After Entry Into Test Cell, LAT Can Easily Be Rotated to Z Axis Horizontal



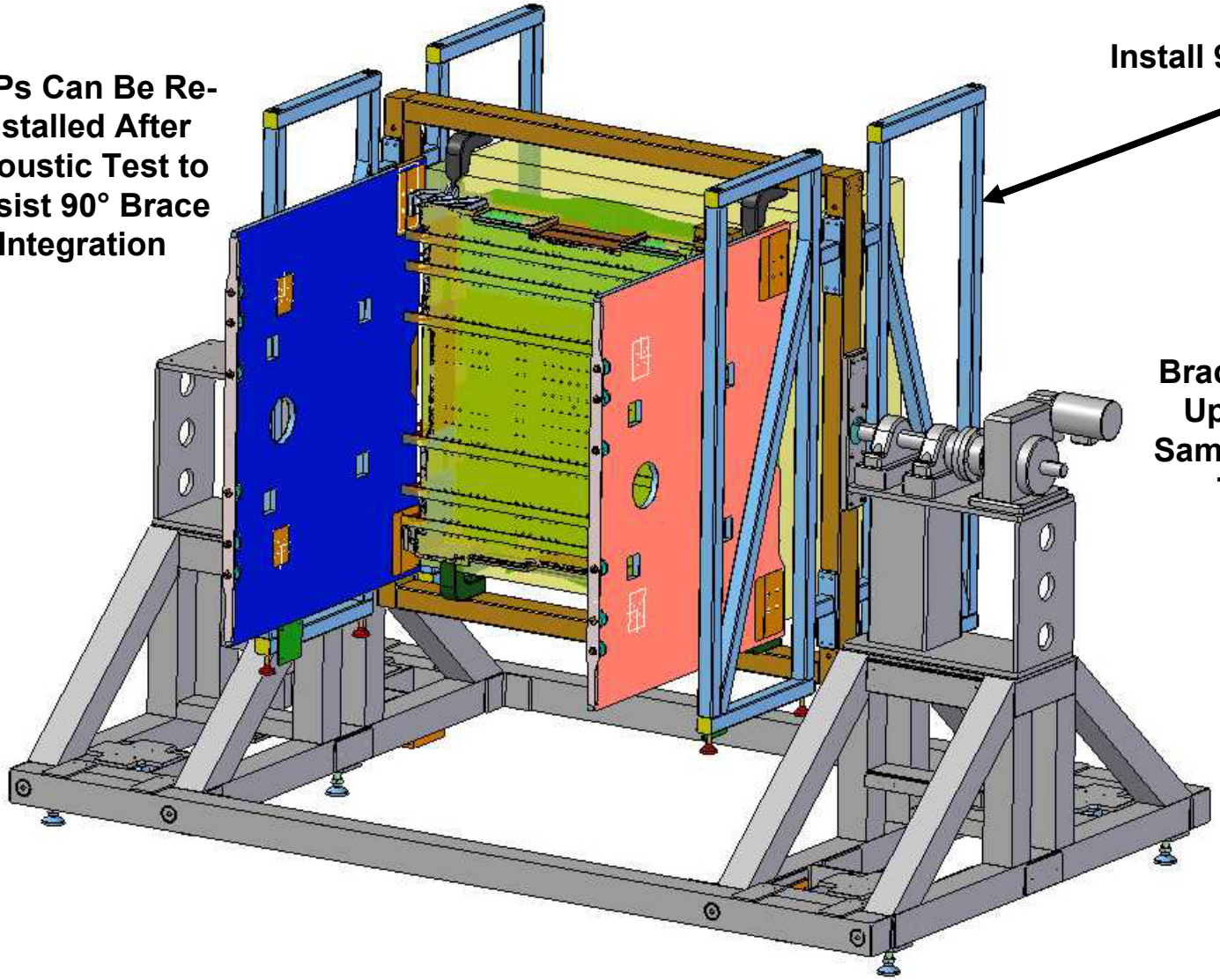
Concern: Latest Model Shows Clearance Between ACD Stay Clear and Door Header is Only 0.5" [12 mm]; Stand Can be Lowered ~ 1.5" [38 mm]

Suggest Survey to Ensure Model is Correct

Prepare For EMI Test, Option 2

PAPs Can Be Re-Installed After Acoustic Test to Assist 90° Brace Integration

Install 90° Brace Set

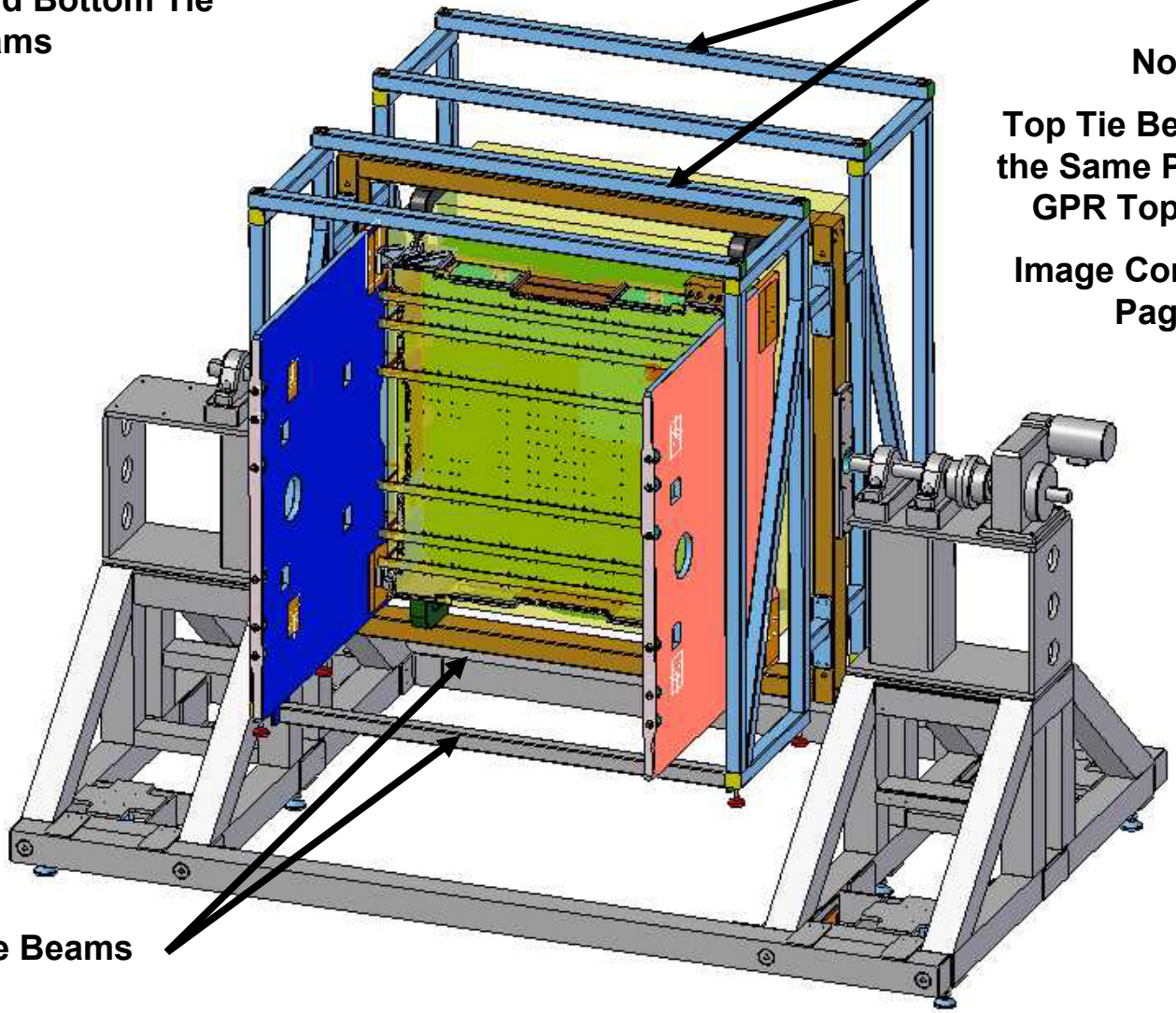


Note

Brace Set has Been Updated to be in Same Plane As GPR Top Surface

Prepare For EMI Test

Install Top and Bottom Tie Beams



Note :

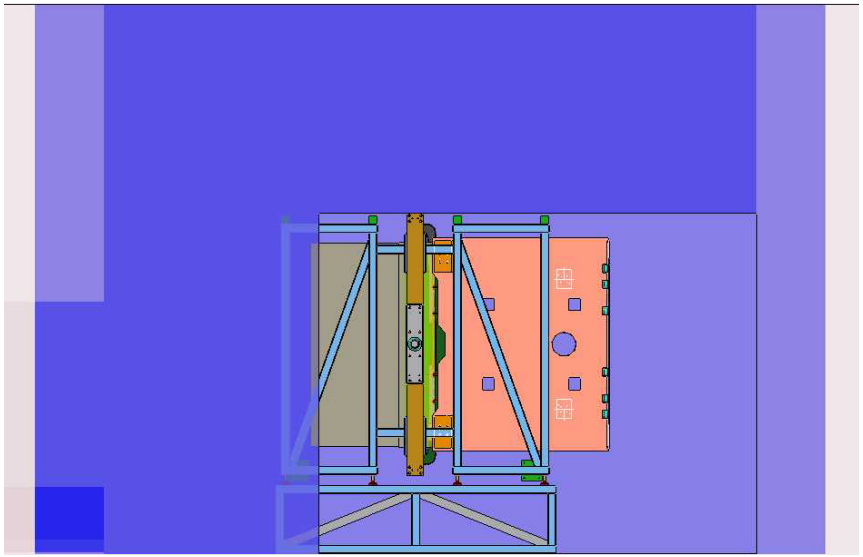
Top Tie Beams Are in the Same Plane as the GPR Top Surface;

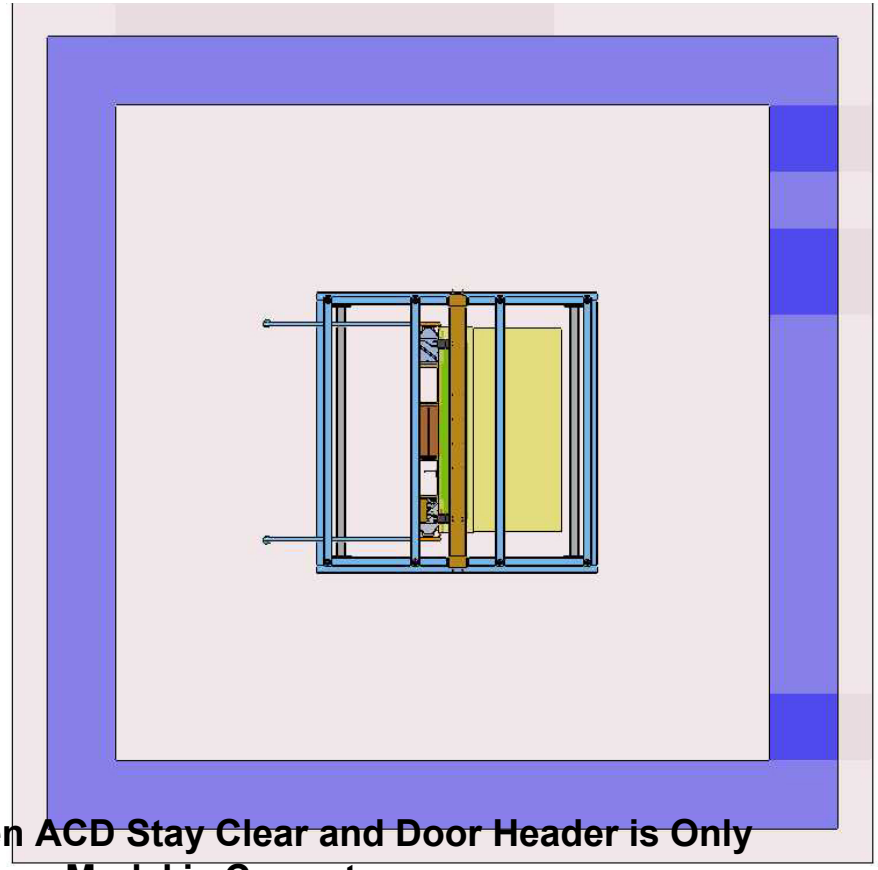
Image Corrected On Page 20

Move To & Scaled Fits In EMI Test Chamber

Option 2,

90° Brace Stand on 2' High Elevator Box Frame





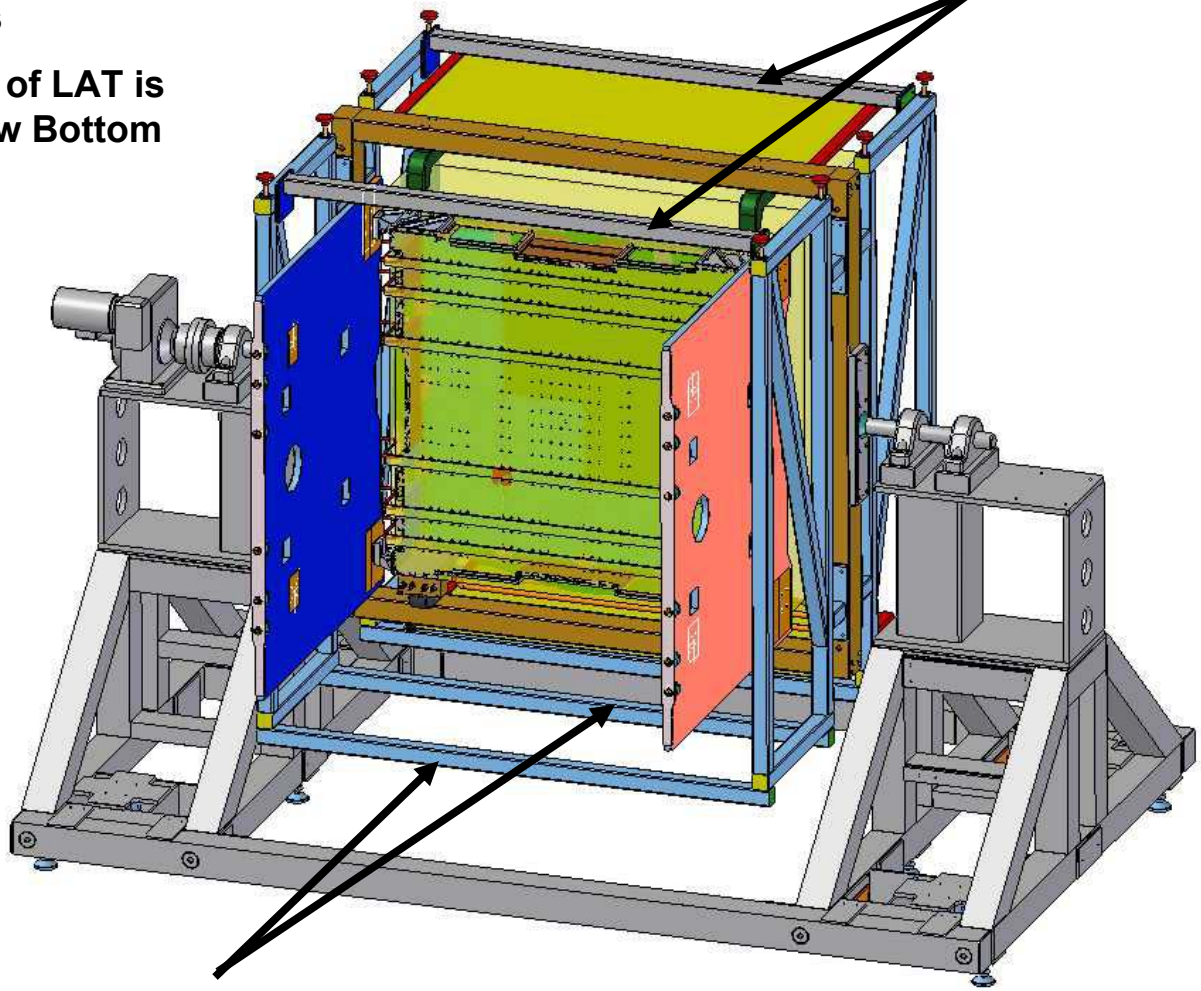
Concern 1: Latest Model Shows Clearance Between ACD Stay Clear and Door Header is Only 1.5" [38 mm]. Suggest Survey to Ensure Model is Correct

Concern 2: NRL Suggestion Was to Have LAT 3' [1 m] From Floor Surface to allow Fit of RF Antennas. Simple Frame Can only be 2' High. May Need Crane in EMI Chamber, or Addition of Jacks to Raise LAT After Move into Chamber

Prepare For T-Vac Test*

Install Top and Bottom Tie Beams

Note: This View of LAT is Inverted to Show Bottom Feet

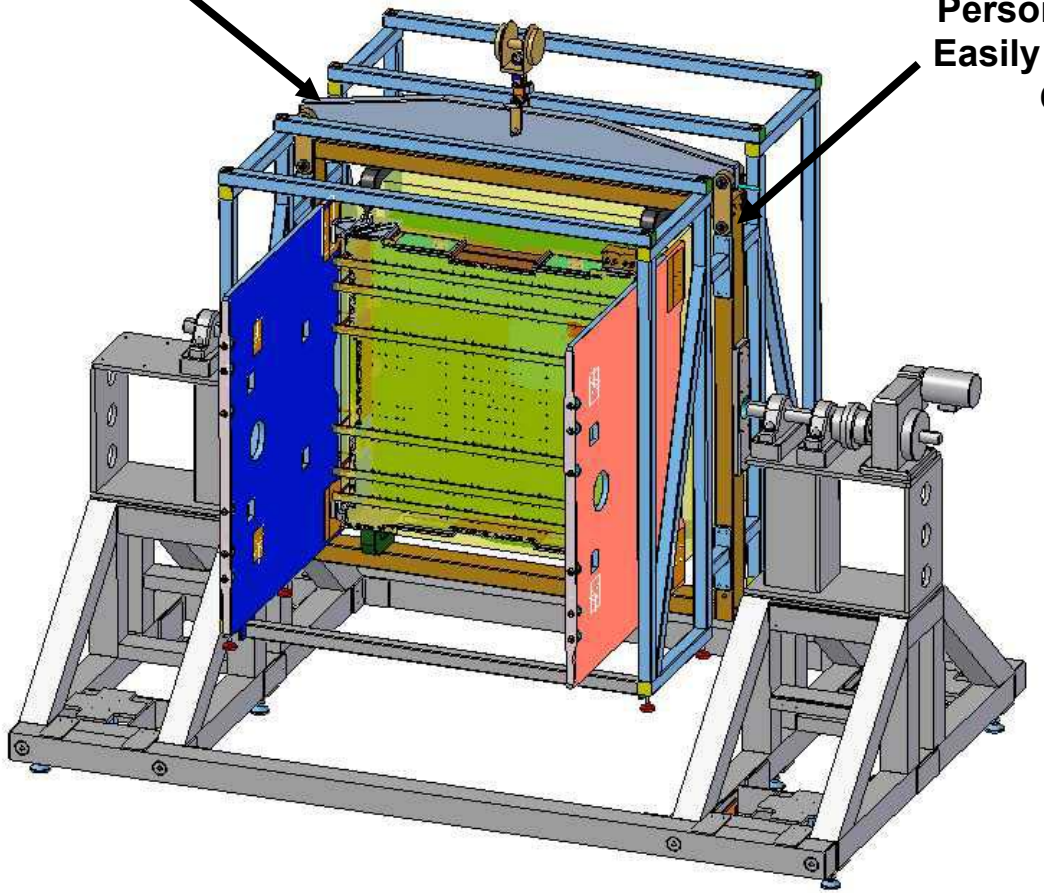


***Note: Or Option 2 EMI Test Prep Continued**

Prepare For T-Vac Test*

Attach Z Axis
Horizontal Lift Fixture

Personnel on PAPs Can
Easily Reach Lift Fixture
Clevice Pins

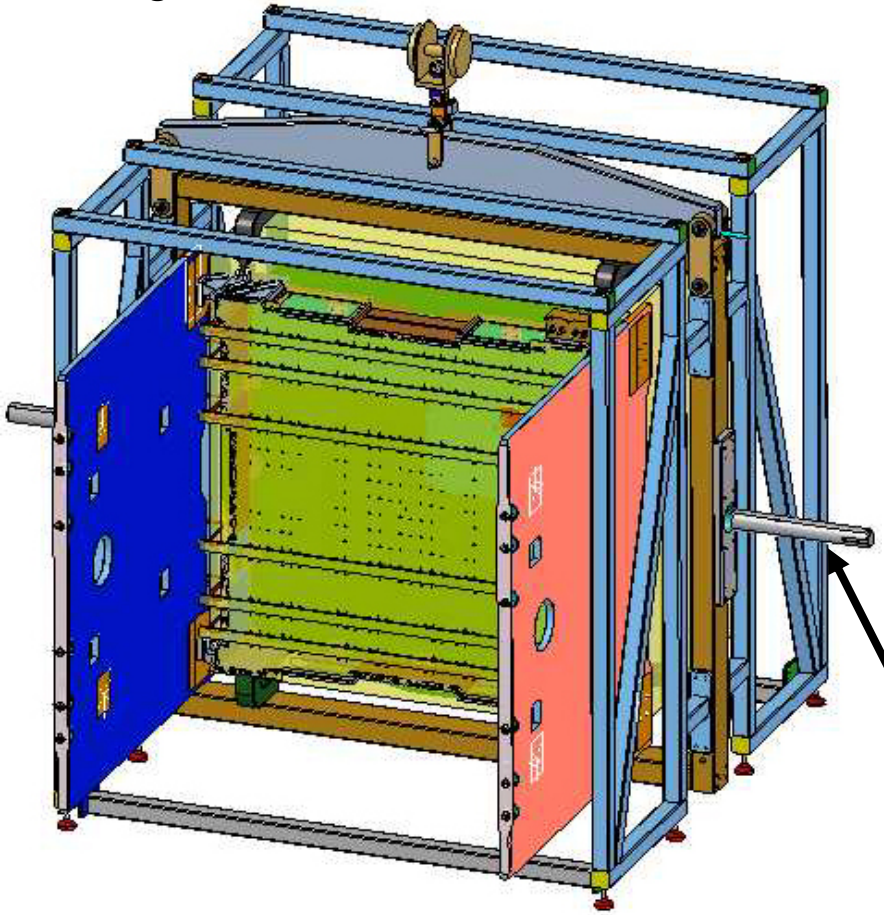


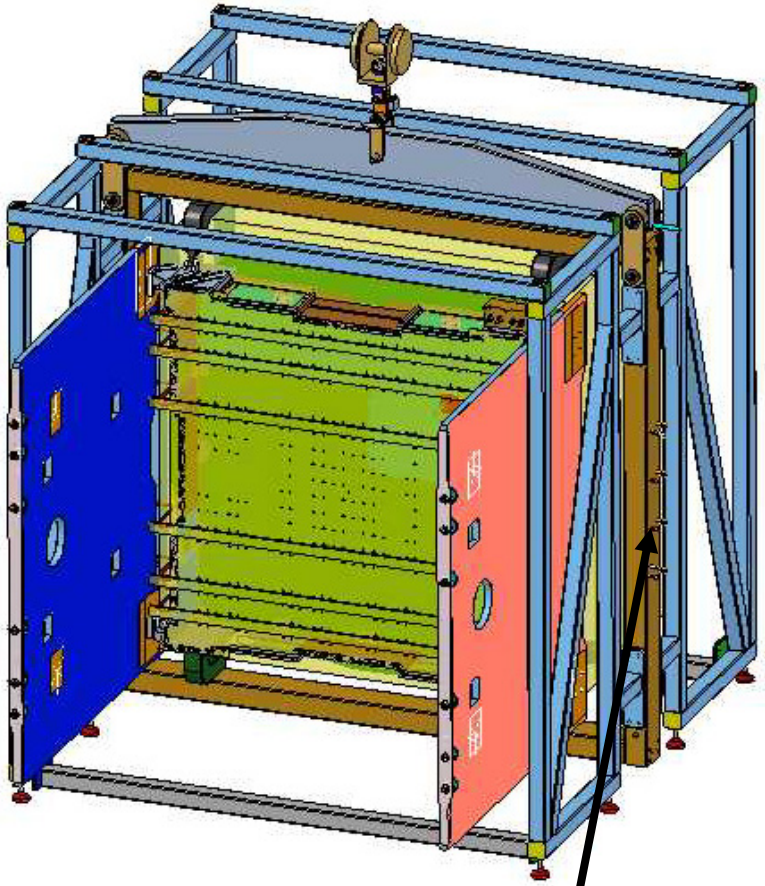
PAPs Not Shown
for Clarity

*Note: Or Option 2 EMI Test Prep Continued

Prepare For T-Vac Test*

Remove LAT From Integration Stand

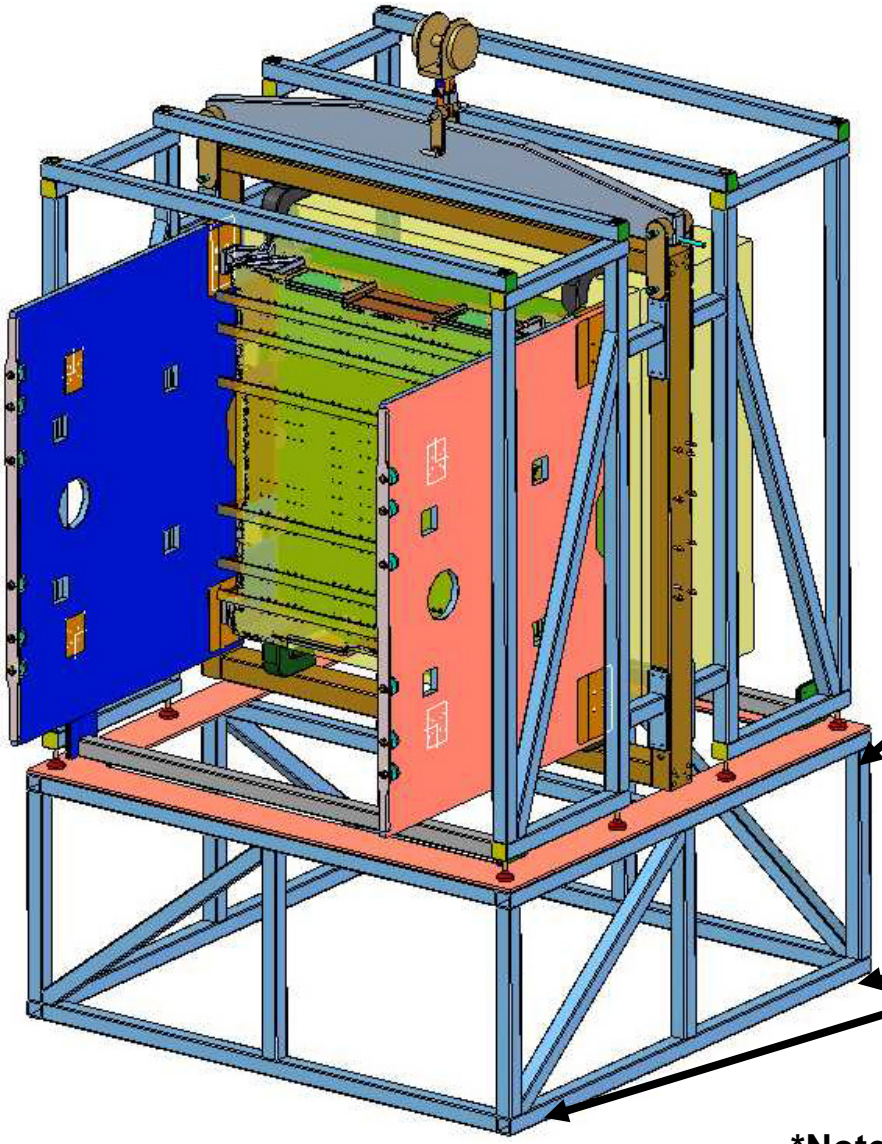




Remove Shafts From GPR

***Note: Or, Option 2 EMI Test Prep Continued**

Prepare For T-Vac Test*



Lift LAT Onto Elevator / Movement Frame, Then Onto T-Vac Trolley Transport

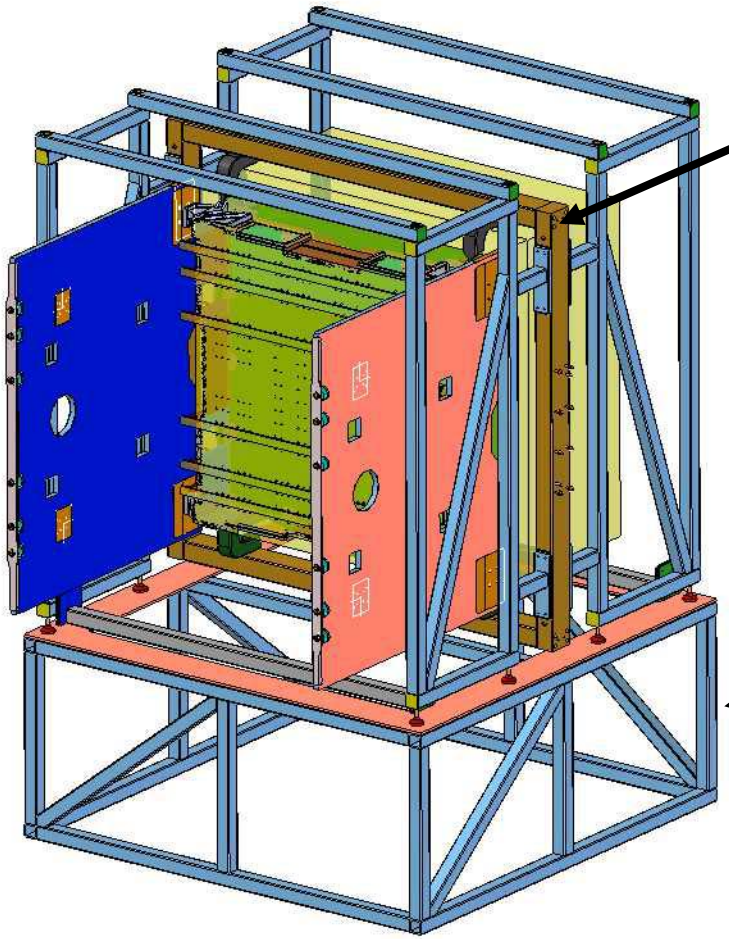
Rough Concept of Elevator Frame (Not to Scale in This View)

2' [0.61 m] High

TBD Air Bearing Supports at Each of Four Corners

*Note: Or Option 2 EMI Test Prep Continued

Prepare For T-Vac Test*



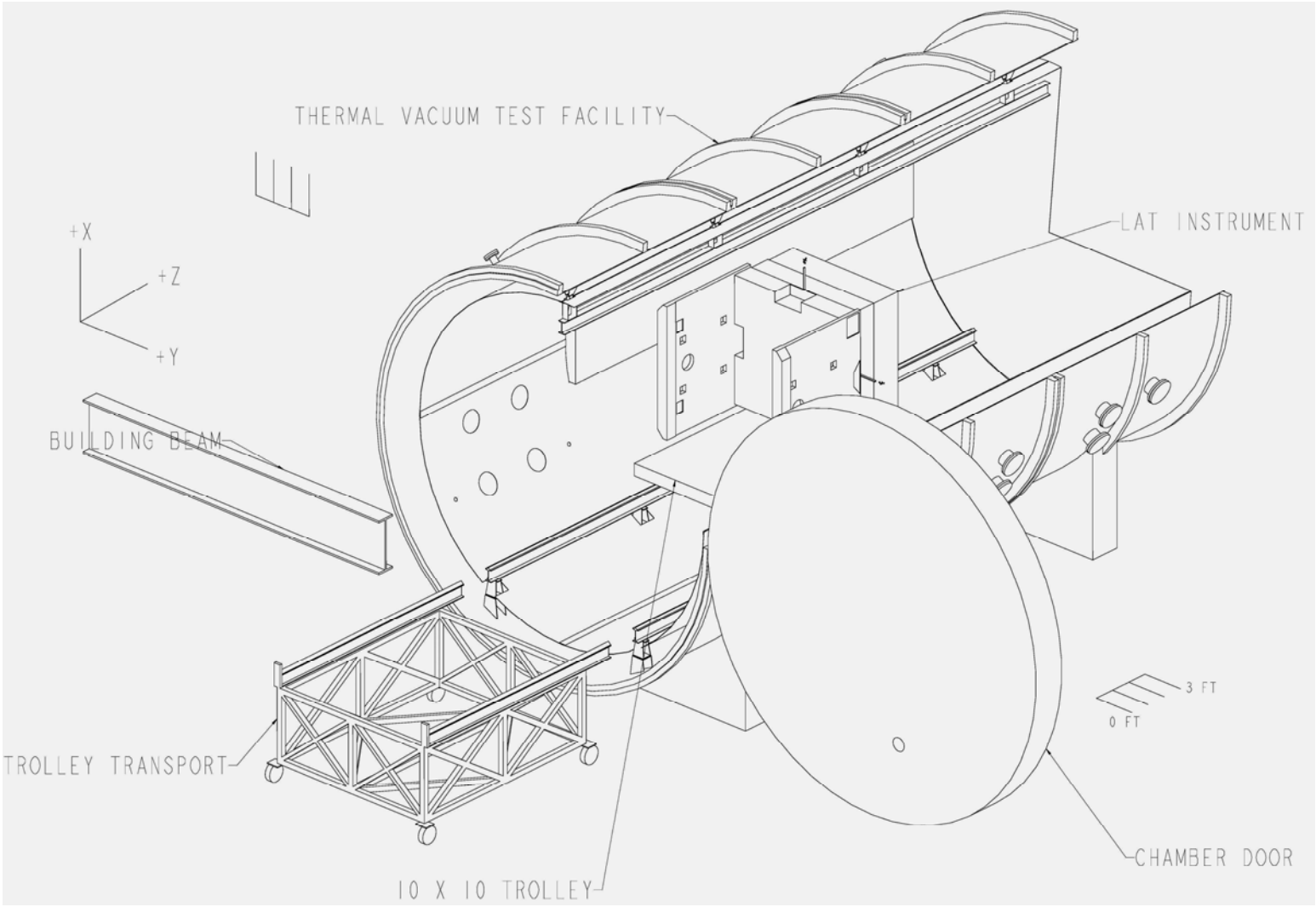
Remove LAT Z Axis Horizontal Lift Fixture

Can Use PAPs if Close Enough, or May Need NRL Personnel Lift Support

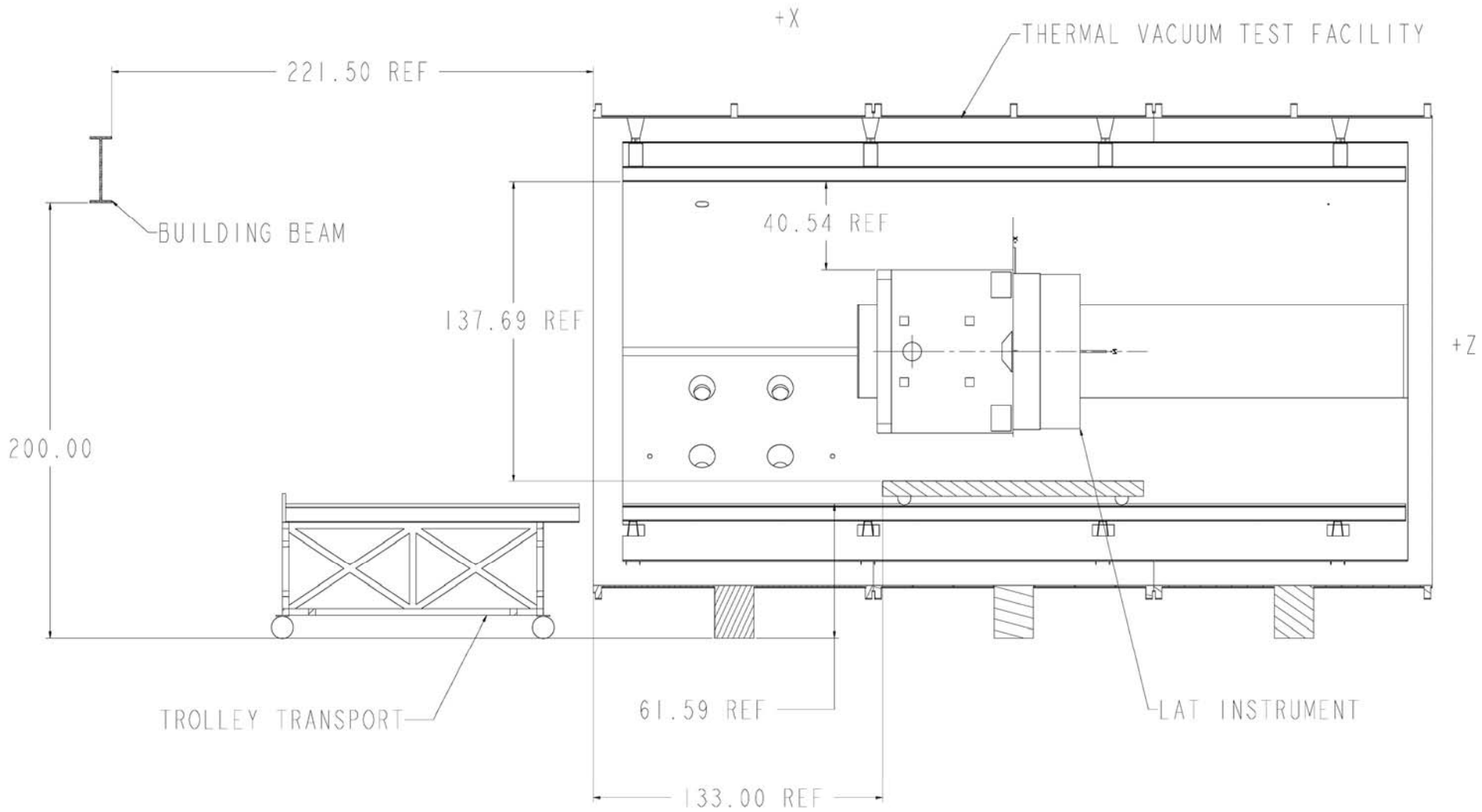
Rough Concept of Elevator Frame

*Note: Or Option 2 EMI Test Prep Continued

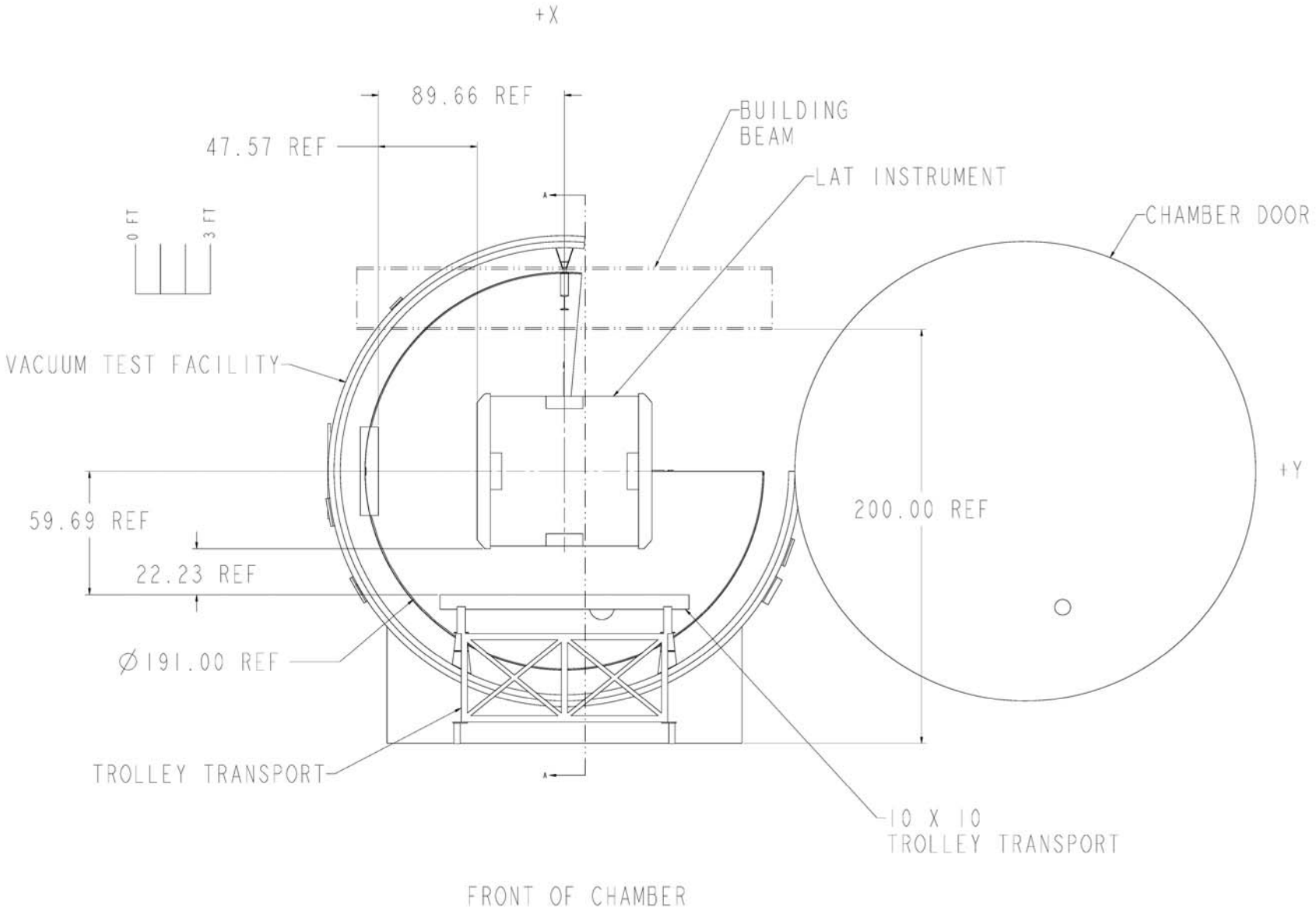
Prepare For Acoustic Test



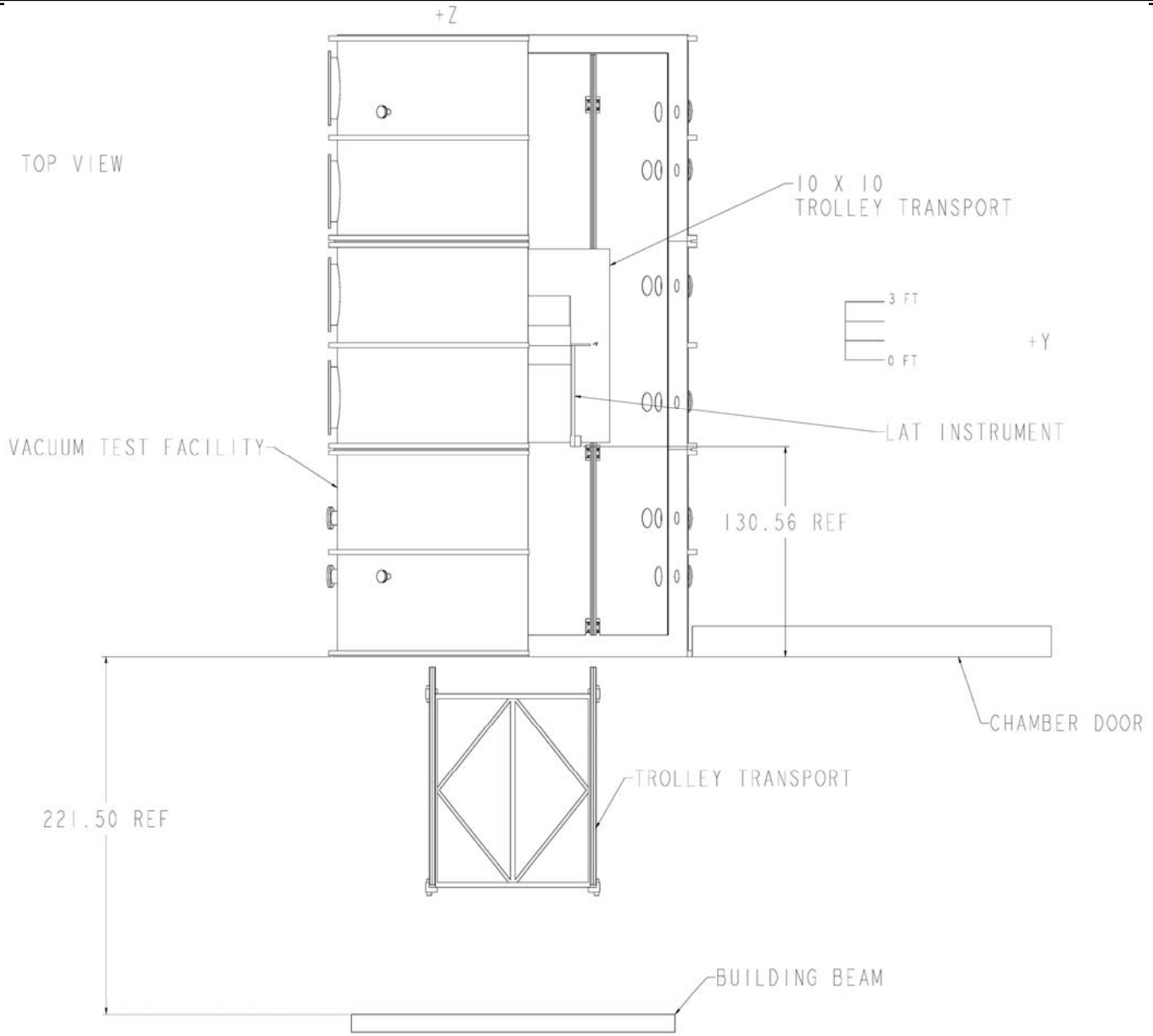
Prepare For Acoustic Test



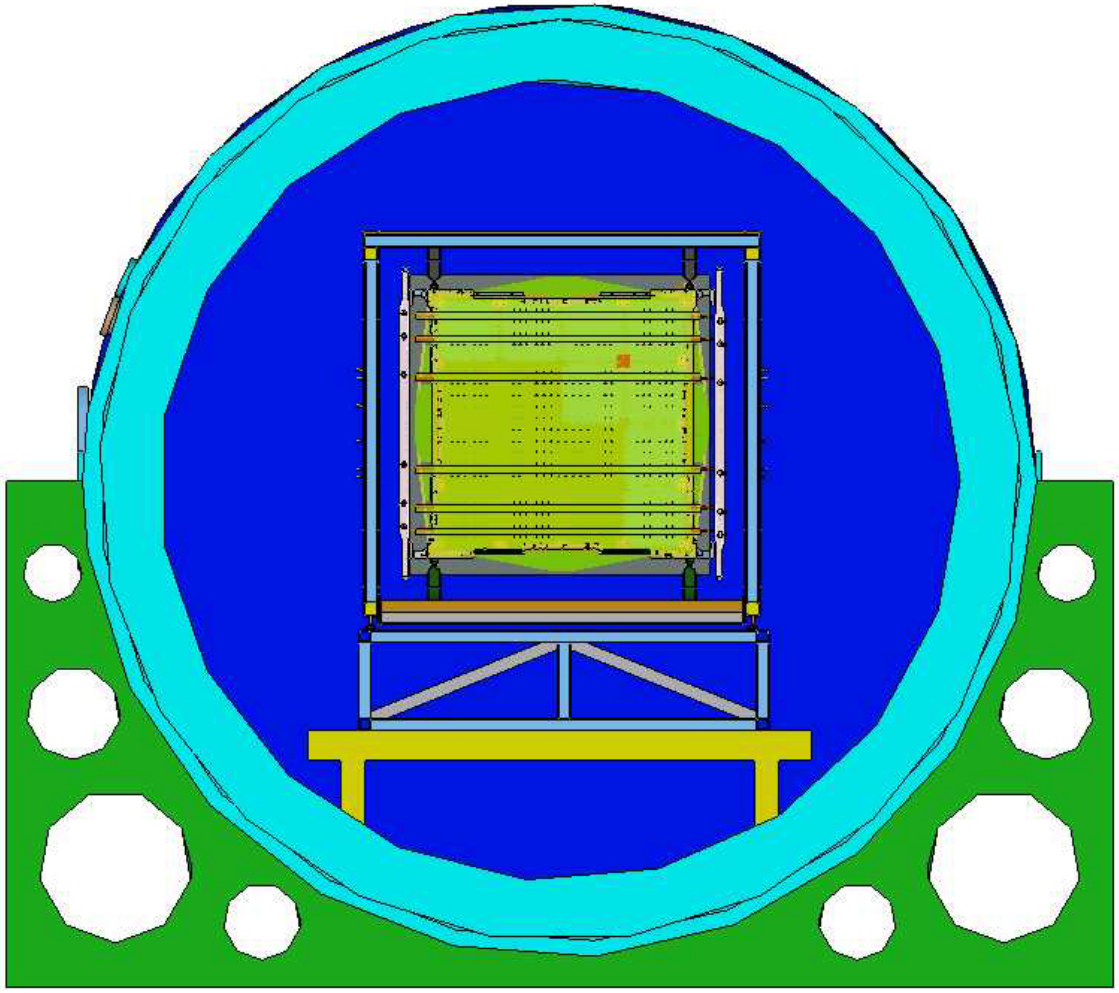
Prepare For Acoustic Test

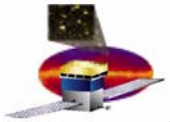


Prepare For Acoustic Test



Prepare For T-Vac Test





Issues – Forward Work

- Require Match Location of SC Flexures to SLAC Provided Vibe-Test "Horse Shoe" Interface Pads
  - Would be Best to Attach "Horse Shoe" Interface Pads to NRL Shaker Interface Plate for Match Location of SC Flexures to Horse Shoes
    - SC Flexures Would Need to be Attached to Very Flat Surface (High Cost)
  - When is A Good Time For This Given Our Schedule ?

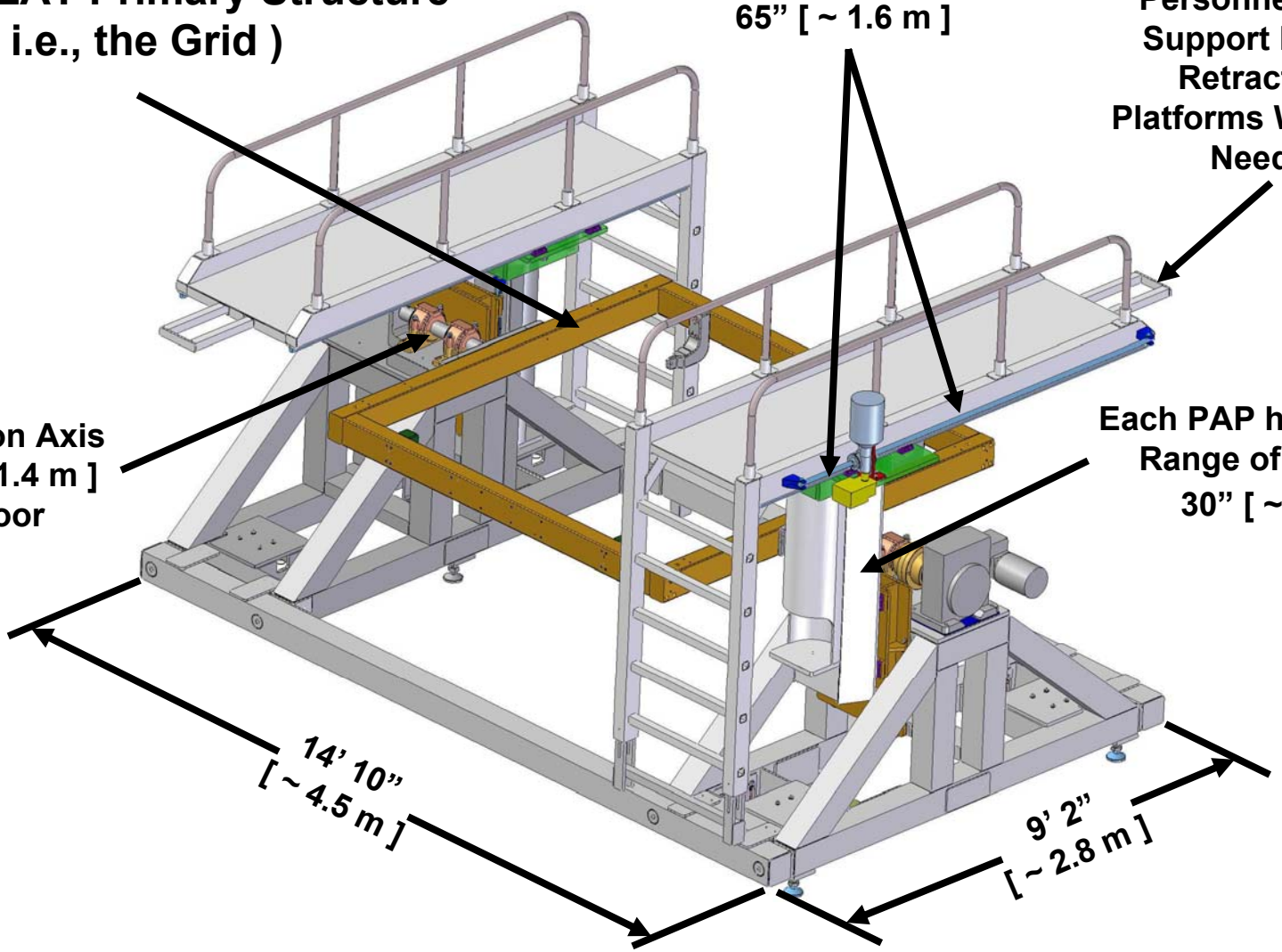
- Require Definition of Lower Radiator Support Struts
  - Need to Design Lower Radiator and SC Simulator Structures
    - Many Available Attach Interfaces Have Been Designed Into GPR

- Is a Crane Available in EMI Chamber ?
  - Does LAT Have to Be 3' From Floor Surface ? Or, Can it be 1.9' ?
    - 3' Will Require Crane or Addition of Lift Method for Transport Frame

Issues – Forward Work

- Need Height of T-Vac's Trolley Transporter
  - Perform Height Checks From Crane Area, Under Beam, to T-Vac Chamber
- Define Where LAT Will Be for Each Test Configuration; Then Define Reasonable Cable Lengths

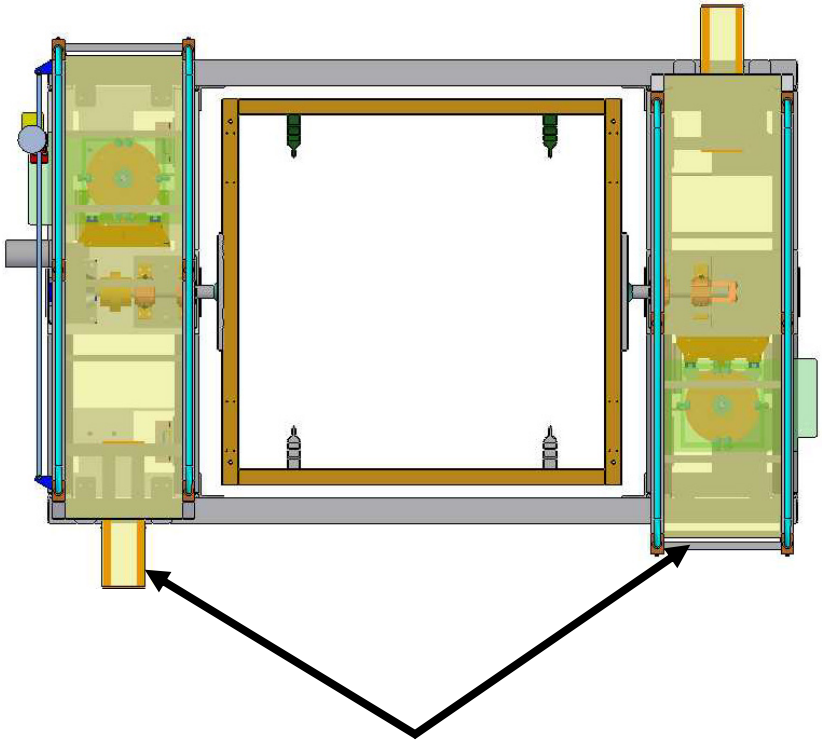
LAT 4x4 Integration Stand, ISO View



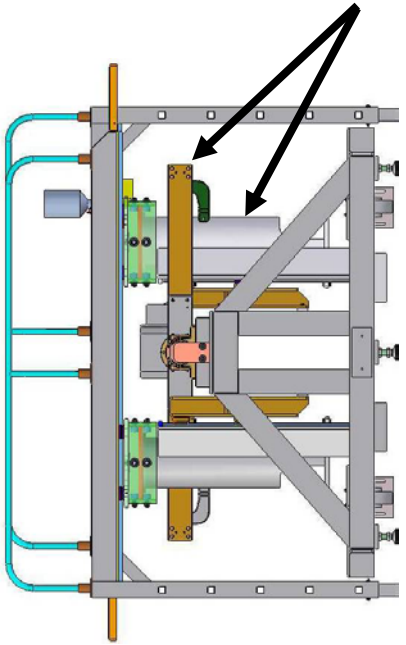
PAP Movement Sequence

Each PAP Motion is Operated "Individually" by a Technician on the Ground. Two "Spotters" Will Provide Feedback to PAP "Driver" to Assist Impact Avoidance

Limit Switches prevent power from being supplied to PAP Drives Unless LAT is Level within ± 1° (TBC)



PAPs Shown in Parked Position

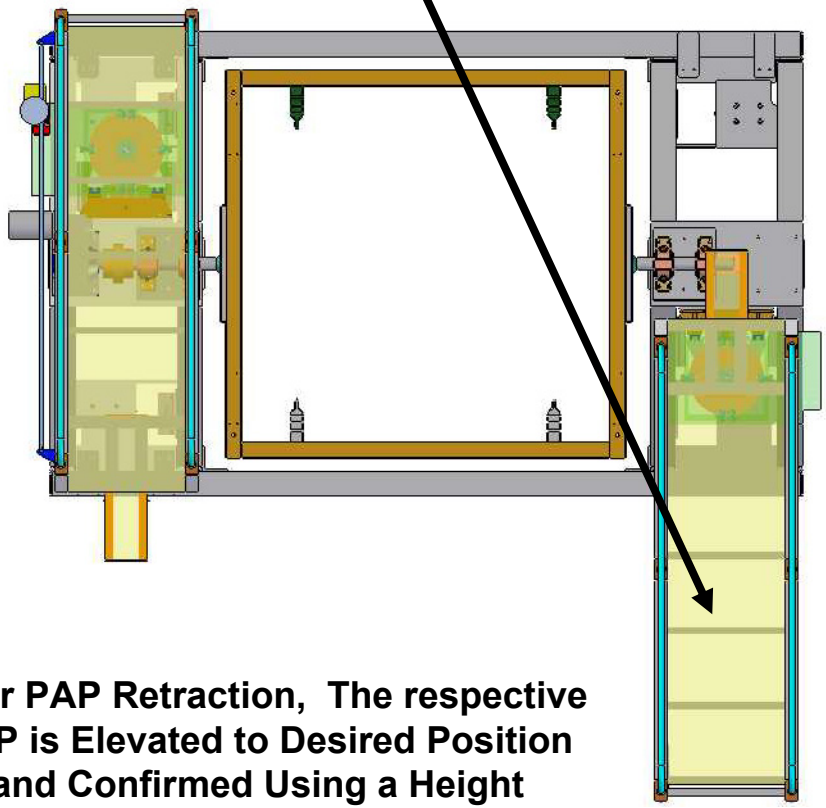


Only One Drive will Receive Power at a Time

PAP Movement Sequence, Continued

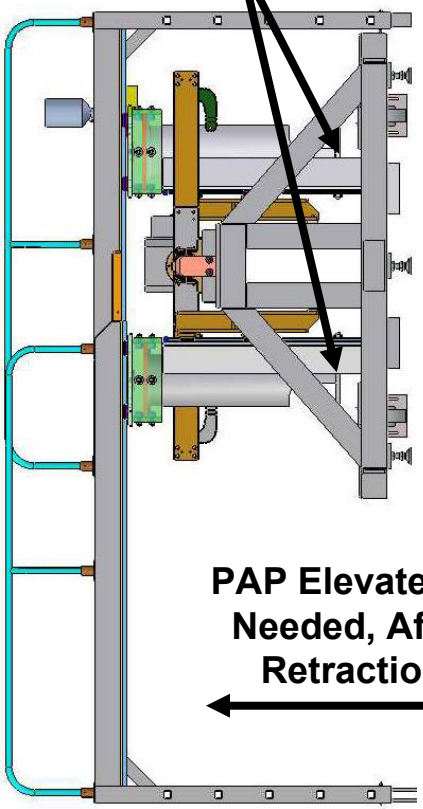
If LAT is Level, One PAP can be Retracted from Parked Position at a Time

Step 1: Retract a PAP



After PAP Retraction, The respective PAP is Elevated to Desired Position and Confirmed Using a Height Validation "Yard Stick"

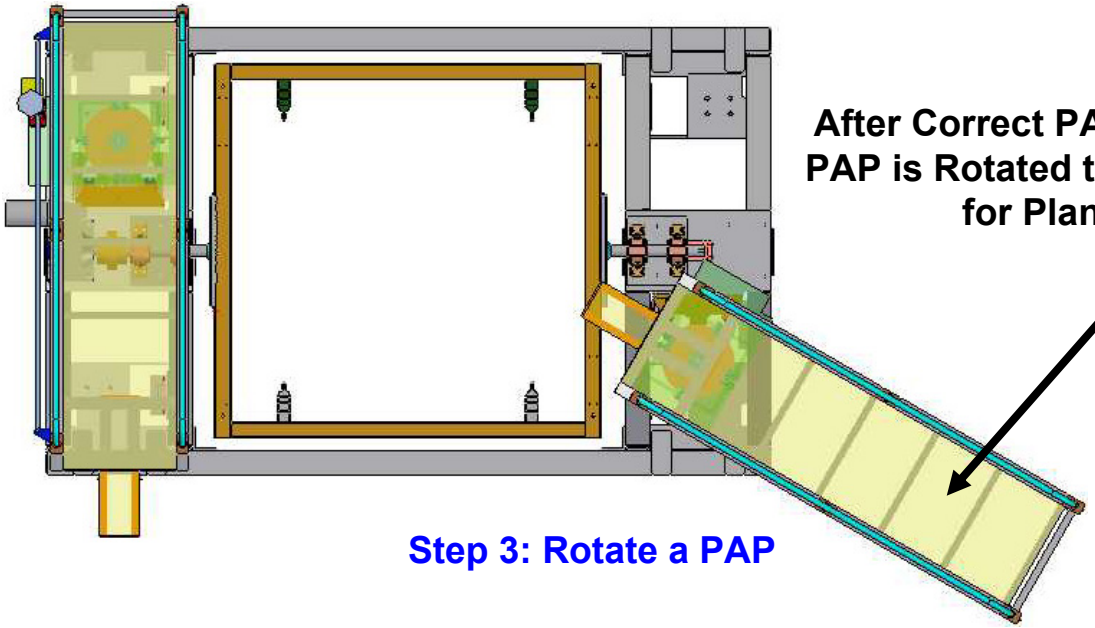
Hard Mechanical Stops will be Adjusted for CAL Access Operations



PAP Elevated, If Needed, After Retraction

Step 2: Elevate PAP to Work Height as Required

PAP Movement Sequence, Continued

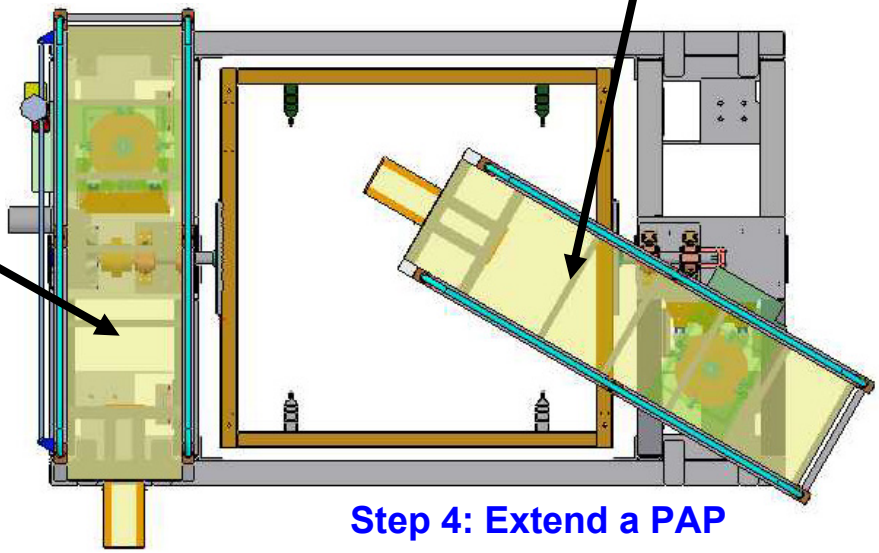


After Correct PAP Height is Verified, the PAP is Rotated to Align with Desired Bay for Planned Operations

Step 3: Rotate a PAP

After PAP Rotation is Complete, PAP is Slowly Extended to Desired Bay

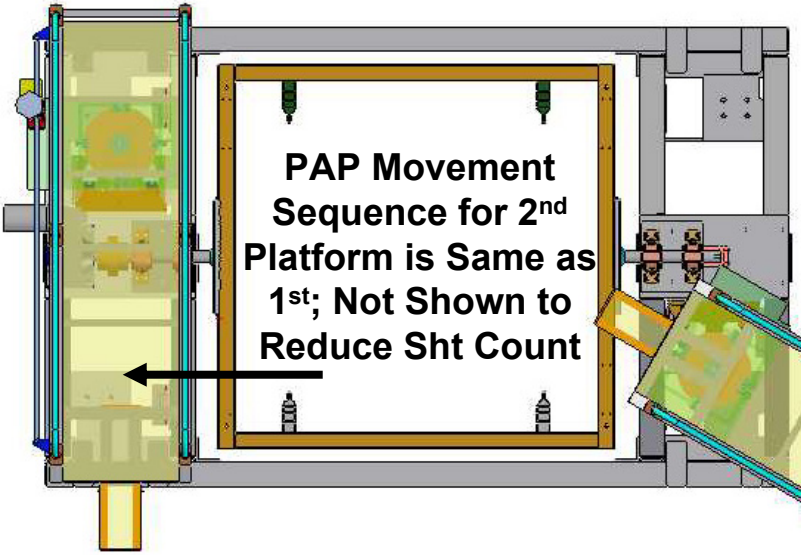
Movement of 2nd PAP Occurs After Completion of 1st PAP, and in the Same Manner



Step 4: Extend a PAP

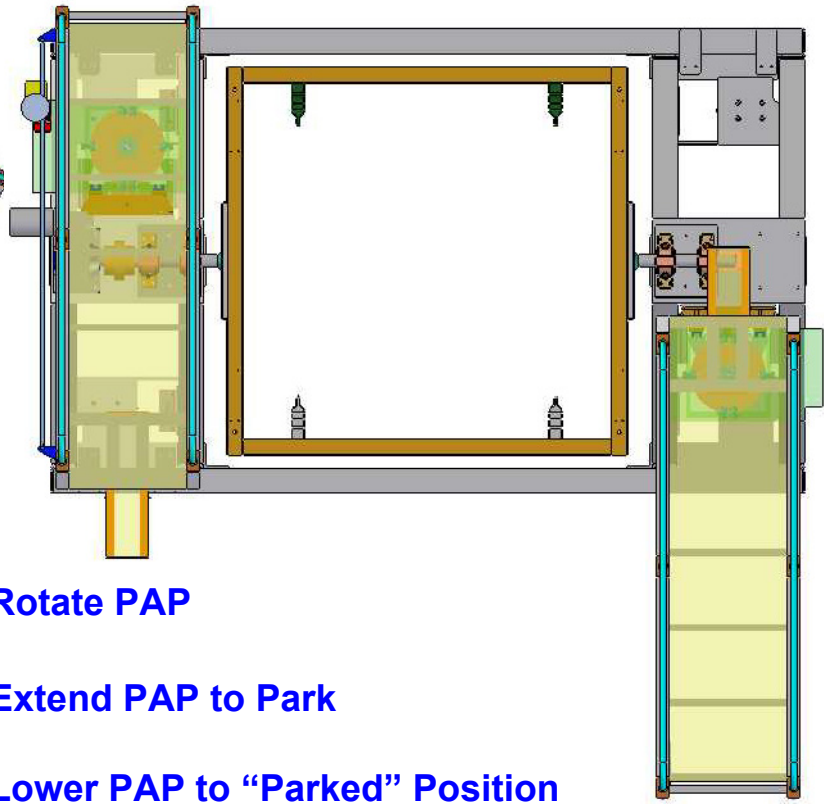
Again, Power is Only Available to One Drive at a Time !

PAP Movement Sequence, Continued



After Bay Operations Complete, PAP is Retracted

Step 5: Retract PAP



Step 6: Rotate PAP

Step 7: Extend PAP to Park

Step 8: Lower PAP to "Parked" Position

For More Information About LAT MGSE

- 4x4 Integration Stand
  - LAT – TD – 03782, Entire
    - Appendix A
      - Contingency Operations – CAL
      - Contingency Operations - TKR
      - Operations Planning History / Summary of Trades

- All LAT MGSE, Go To:

  http://www-glast.slac.stanford.edu/IntegrationTest/MGSE/default_MGSE.htm